May 19, 1950

BRITISH DENTAL JOURNAL

The Journal of the British Dental Association

(Incorporating the "Mouth Mirror" and the "Dental Gazette")

First and Third Fridays in each month

Price to non-members · 2s. per copy. Postage 3d. Annual Subscription £2 2s. post free

CONTENTS

Original Communications PAGE

Chondrosarcoma of the Maxilla. By Professor A. E. W. MILES, F.D.S., M.R.C.S.Eng., L.R.C.P.Lond. 257

Improvements in Electro-forming Dental Dies. By EDWIN ROSENSTIEL, L.D.S.Manc. 269

Short Communication

Re-eruption of a Deciduous Incisor. By W. MALCOLM GIBSON, M.B., Ch.B., F.R.F.P.S., L.D.S. .. 275

Practical Note

A Modified Design for a High-Labial Retainer for Kennedy Class I and II Cases. By K. STRAUSS, L.D.S.Eng. 275

Orthodontic Note

The Role of Observation and Simple Treatment in the Practice of Orthodontics.. 276

Continued overleaf

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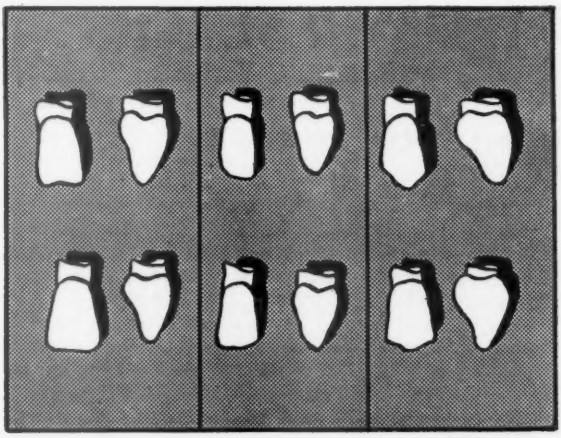

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CONTENTS—*continued*

Editorial

The Services 277

Notes and Comments PAGE

Parliament and the School Service 278
Aptitude Tests for Dental Students 278
Sections 279
Percy R. Howe 279

Fifty Years Ago 279

Letters to the Editor

The Benevolent Fund (E. B. Dowsett) .. 279
Fluorine and War-time Diet (Charles Dillon) 279
The Amalgam Restoration (John C. Dominick) 279
Bringing Orthodontics to the School Child (E. K. Breakspear) 280
Food and Preventive Dentistry (C. E. Thomas) 280
Xylocaine (Norman Siggers) 280

Reviews and Abstracts 281

The Health Service 284

Parliamentary Intelligence 285

Dental News 287

The Schools 288

The Services 288

Personalia 288

Obituary

Harold Osbert Salt 288
Harold Harrison 288
Victor William Percival 288

Our Diary 288

British Dental Journal 288

Supplement

Association Notices 59

Annual Meeting, Birmingham, July 10–14, 1950 .. 59

The Representative Board 60

P.D.O. Group Notes 64

Branches and Sections 64

Correspondence

The Cut (Eric W. Manners) 64
„ „ (J. S. Selby) 65
The Cut and Conservative Fees ("Mainly Conservative" Worker) 65
Local Authority Dental Services (J. L. Clay) 65

Changes of Address 65

New Members 66

Forthcoming Meetings at Headquarters 66

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BRITISH DENTAL JOURNAL

The Journal of the British Dental Association

VOL. LXXXVIII MAY 19, 1950 No. 10

ORIGINAL COMMUNICATIONS

CHONDROSARCOMA OF THE MAXILLA

BY PROFESSOR A. E. W. MILES, F.D.S., M.R.C.S.ENG., L.R.C.P.LOND.

CARTILAGINOUS tumours arising in the jaws are unusual. There appears to be a general impression that they are less common in the maxilla than the mandible; for example, Geschickter (1935) states "cartilaginous tumours arising in the maxilla have not been recorded and should not occur in this membranous bone." Nevertheless a search of the literature has revealed a number of cases of chondrosarcoma affecting or arising in the maxilla.

In some of these cases the disease was so advanced when first seen that it was quite impossible to determine the exact site of origin; in others the maxillary sinus was invaded or filled with the tumour mass so that it was difficult to say from which part of the surrounding bone the tumour originated, while in others there were presenting symptoms of nasal obstruction which suggested that the lateral wall of the nasal cavity was the site of origin.

The main features of the cases discovered in the literature are set out in Table I. In surveying the literature attention has been directed chiefly, but not exclusively, to those cases in which the neoplasm appeared to have arisen in the maxilla itself. Those cases in which the description is not detailed enough to be of any value for the purpose of study have not been included in the table, nor have those in which there was strong evidence that the ethmoidal or sphenoidal regions were the sites of origin, but three cases in which the evidence of such an origin was not so strong have been included. This was considered desirable in order to increase the number of cases as far as possible, even though the primary site of origin was in doubt, so that some idea of the age of onset, behaviour and results of treatment of these neoplasms might be obtained.

A review of the literature previous to 1938, on chondrosarcoma of the maxillo-ethmoid region, was undertaken by Ringertz (1938). He found that these tumours were mostly localised in the middle and superior sections of the maxillo-ethmoidal regions and none appeared to have grown mainly in the alveolar process of the maxilla.

In the two cases which are reported here, not only did the swelling first present in the alveolar portion of the maxilla, but when first seen the maxillary sinus was not involved and there were no symptoms of nasal obstruction. It would appear, therefore, that the site of origin was in the body of the bone below or in front of the maxillary sinus, or actually in the alveolar process. In only three cases in the literature is there evidence of a similar site of origin.

The first is that reported by Roper-Hall and Adcock (1939). A woman of 51 years presented with a hard swelling in the anterior region of the right maxilla. The mass was removed and the histological report indicated diffuse chondroma. Two years later the swelling recurred in the palate and at operation was found to extend up to the floor of the nose. The histological diagnosis was now chondrosarcoma.

The second case is one included in the records of the Registry of Dental Oral Pathology, U.S. Army Institute of Pathology (Mann *et al.*, 1944). A small tumour was removed from the gingiva of the right maxilla of a Negro man, aged 40 years. X-rays showed a shadow in the right maxillary sinus and some involvement of the right ethmoidal sinus. The histology, which is described in some detail, was that of a chondrosarcoma. The involvement of the nasal sinuses in this case raises the question of whether the intra-oral swelling was an extension from a growth arising in the nasal cavity or maxillary sinus.

The third case is one which was published by Ringertz, and classified by him as an osteosarcoma. There is reason to believe, however, that it was actually a chondrosarcoma. A woman of 29 years presented with a bony-hard swelling of the maxillary alveolar process close to the mid-line. It grew rapidly, crossing the mid-line, and at operation the whole of the alveolar process was found to be involved. The maxillary sinus did appear to be encroached upon. Although the report on the tissue removed was "osteoblastic osteogenous sarcoma," according to Ringertz the report on a preliminary biopsy indicated chondrosarcoma. The photomicrographs which are clearly reproduced in his paper show large masses of cartilage and the histology resembles very closely that of the two cases of chondrosarcoma here reported. There appears, therefore, to be justification for including Ringertz' case in this survey.

The tumour recurred soon after the operation and, following the removal of more tissue by electro-coagulation, radium was inserted into the cavity with apparently considerable effect, for at the time of death from a large lung metastasis three years after onset, the site of operation was free of local recurrence. The lung metastasis presented the histological appearance of spindle-cell sarcoma and contained no bone or cartilage.

Two cases of chondroma arising from the alveolar portion of the maxilla appear in the literature. One is described by Pincus (1938) in an edentulous woman of 56 years who presented with a softish sessile growth in the upper incisor region. There was an uncertain history of onset five years previously. The tumour was composed of angiomatous tissue with an area of cartilage surrounded by fibrous connective tissue. The cells of the cartilage were irregular in size and shape.

The other is a case mentioned by Thoma (1949) who shows a photograph of a chondroma which forms a rounded, apparently pedunculated swelling about the size of a walnut, attached to the edentulous gum in 321| region. No other details are given.

Thoma (1934) also described an enchondroma of the maxilla which, although the actual site of origin is doubtful, it is useful to quote in some detail because it illustrates the features of this type of neoplasm. The patient was a woman of 52 years whose right upper jaw had begun to increase in size six years previously. Eight months before she was seen, it had increased in size rapidly. The swelling bulged down the palate, protruded into the nasal cavity and there was marked exophthalmos of the right eye. The upper jaw and eye were removed and the neoplasm, which was about the size of a tennis ball and encapsulated in a thin bony shell, was found to have eroded the base of the skull so that the dura was exposed at operation. She made a good recovery, and there was no evidence of recurrence seven years later.

Heath (1887) mentions a number of enchondromas of the upper jaw similar to Thoma's case. They grew to an enormous size and the site of origin is impossible to assess. Recurrence was a feature of some and in no case does the author specifically mention the involvement of the alveolar portion of the jaw.

Willis (1948), Roper-Hall and Adcock (1939), Geschickter and Copeland (1949), have pointed out that chondromas often recur locally unless widely excised and that they frequently exhibit in this way a clinical malignancy which cannot always be recognised from the histological appearance. This is borne out by a number of cases in the literature, such as those described by Heath, which have been reported as chondromas and yet have shown a marked tendency to recur. It is doubtful whether the recurrence in such cases can be taken as evidence of malignancy since it may have been due to difficulty in eradicating a central tumour in this situation, or to reluctance to do so in order to avoid a mutilating operation. As will be seen later Lichtenstein and Jaffe (1943) give criteria for distinguishing benign chondroma from chondrosarcoma.

It is possible that cases of chondrosarcoma other than those included in Table I may have been reported as cases of osteogenic sarcoma since, as will be seen, there has been a tendency to place chondrosarcoma in the general category of osteogenic sarcomas, refusing to accept it as a separate entity. On the other hand, although an exhaustive survey of all the reported cases of osteogenic sarcoma of the maxilla has not been undertaken, no cases of osteogenic sarcoma of that bone in which cartilaginous elements were predominant has come to my notice, with the exception perhaps of the case published by Ringertz.

Possibility of Origin from Vestigial Rests of Cartilage

At first sight, as is implied by the statement of Geschickter quoted above, it might seem surprising to find cartilaginous tumours arising from the maxilla or premaxilla which are usually regarded, on both phylogenetic and ontogenetic grounds, as being primarily membrane bones. Nevertheless cartilage does play an active part in the development of at least one part of the maxilla, and both maxilla and premaxilla are

closely related to parts of the chondrocranium throughout their development. The occurrence of vestigial rests of cartilage within the substance of these bones, therefore, appears to be a theoretical possibility.

The maxillary sinus appears at about the 4th month of fœtal life as a shallow outgrowth from the lateral wall of the nasal sac. The details of the subsequent developmental relationship of this outgrowth of the nasal epithelium and the adjacent portion of the lateral wall of the cartilaginous nasal capsule is not entirely clear. It seems probable, however, that this part of the nasal capsule retrogresses as the developing maxillary sinus invades the maxilla and it might be possible for remnants of cartilage to be carried into the bone and persist as embryonic rests.

The paraseptal cartilages (anterior paraseptals of Fawcett, 1924) are situated on the ventro-lateral aspect of the nasal septum. The anterior portions of these cartilages are initially situated in close relationship to the dorsal aspect of the premaxillæ and become partly enclosed by the subsequent growth of this bone (fig. 1). It seems possible that remnants of the paraseptal cartilages could persist within the substance of the premaxilla.

Roper-Hall and Adcock suggest that " portions of cartilage may be entrapped from the developing nasal septum between the developing halves of the palate, as they approach from each side, or from the nasal septum itself by extension of cartilage via the incisive canal to the palatal surface." It would appear more probable that areas of cartilage incorporated at the sites mentioned are of paraseptal origin rather than detached portions of the nasal septum.

The cartilage considered so far is part of the primordial cartilage skeleton. Areas of cartilage which cannot be referred to any recognised parts of the chondrocranium are also seen in membrane bones. This type of cartilage is usually referred to as " secondary cartilage " (*see* de Beer, 1937, pp. 2 and 502). Areas of cartilage of this nature in the mental region, coronoid process and condyle of the mandible are well recognised. They are invariably present in the developing mandible and are of constant situation in contradistinction from the " chondroid bone " referred to below.

A small mass of cartilage appears at about the 27 mm. stage within the developing human maxilla on its lateral aspect in the region of the malar process. At this early stage this cartilage is situated very close to the germs of the developing molar teeth, as can be seen in figs. 2 and 3. While this is usually regarded as " secondary

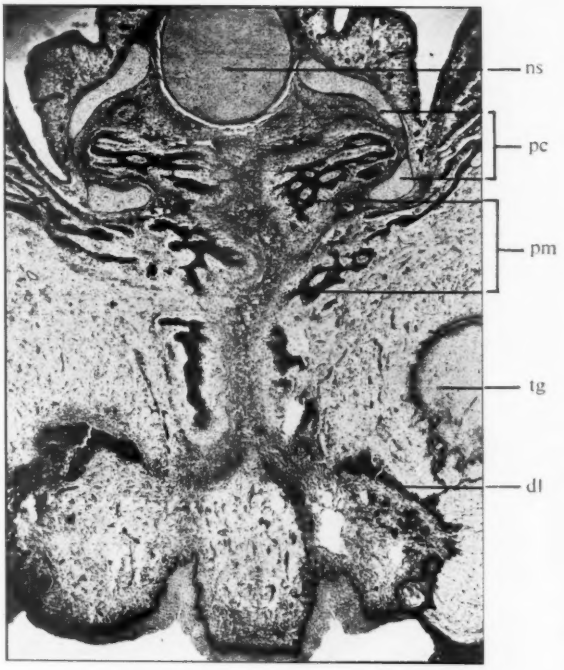

FIG. 1.—Coronal section through the premaxillary region of a 145 mm. human embryo, showing the manner in which the paraseptal cartilages become partly surrounded by the developing bone of the premaxillæ. Stained Masson's Trichrome. × 18. dl. dental lamina ; ns. cartilage of nasal septum ; pm. developing premaxilla ; pc. paraseptal cartilage ; tg. tooth germ.

cartilage," Fawcett (1924) suggests that it may be the anterior end of the palato-pterygo-quadrate cartilage. Its interest in the present connection is in the fact that it provides a possible source of vestigial cartilaginous rests.

Areas of tissue having an appearance strongly suggestive of cartilage of which the matrix has calcified are sometimes found within the substance of the developing jaws. Unlike " secondary cartilage " it does not appear to be distributed according to any pattern. Lehner and Plenk (1936) call this tissue " chondroid bone " and state that it tends to develop in situations of particularly rapid growth, such as the alveolus and angle of the mandible. Bone of this nature in the developing maxilla is shown in fig. 4.

If either bone or cartilage may develop according to circumstances, the histogenetic distinction between these two tissues cannot be very well marked. According to Le Gros Clark

FIG. 2.—Coronal section through the posterior part of the maxilla of 47 mm. human embryo, showing the mass of cartilage developing on its lateral aspect. Malar cartilage (Fawcett). Stained hæmatoxylin and eosin. × 26. bv. blood vessel; max. developing bone of maxilla; ns. nasal septum; cart. cartilage mass; i.orb.n. infra-orbital nerve; v. vomer.

(1945) " experiments *in vitro* indicate that there is no fundamental difference between young cartilage cells (chondroblasts) and osteoblasts. The one may become transformed into the other in either direction." Fell (1933) found that, when cartilage-free bone from the tibiæ of fowls was grown in culture, cartilage cells developed as well as osteoblasts. Furthermore, it is well known that during the healing of fractures cartilage often appears in the callus. According to Weinmann and Sicher (1947) this is true of the healing of membrane bones as well as of those preformed in cartilage. It has not been possible, however, to find any evidence in the literature to support this statement and Sutro and Jacobson (1939) in an experimental investigation of fractures of the calvarium in rats, comment on the absence of cartilage from the callus.

Consideration of the embryology of the bone concerned is made because of the view first put forward by Cohnheim (1875) that tumours arise from embryonic rests composed of the parent tissue of the neoplasm. This is a view that does not receive much support from pathologists at the present time, but should naturally be considered in the case of tumours the parent tissue of which is not usually regarded as a component of the tissues in which the tumour is arising.

Origin of Cartilage by Metaplasia

It is well known that, in neoplastic tissues, particularly malignant ones, metaplasia may occur. Cartilage may arise in this way in totally unexpected places; for example, Willis (1948, p. 648) refers to a subcutaneous fibroma which contained islands of cartilage.

In any osteogenic sarcoma it is not uncommon to find cartilage (Dible and Davie, 1947; Lichtenstein and Jaffe, 1943; Willis, 1948). According to Kolodny (1927), " the majority of osteogenic sarcomas show a conglomeration of various tissues of mesoblastic origin and if one makes an exhaustive search one rarely, if ever, fails to encounter all or several of these tissues. In one fibrous tissue will predominate, in another osteoid, in still another myxomatous, and in others cartilage or bone will predominate."

Classification

For the reason mentioned in the last paragraph Kolodny refused to accept chondrosarcoma as a clinical entity separate from osteogenic sarcoma and in 1928 this became the official view of the Bone Sarcoma Registry of the American College of Surgeons (Ewing, 1939). The Registry produced a classification in which all sarcomas derived from the ancestors of cells which, when fully differentiated, are osteoblasts, were grouped under the heading osteogenic sarcoma, whether or not the tumours were actually bone forming. Although six clinical types of osteogenic sarcoma were distinguished in the classification, chondrosarcoma was not one of them. According to Ewing (1939) this classification was used widely in American surgical clinics during the years that followed, and its influence extended to other countries.

In 1939, however, the Registry revised their classification in the light of further experience of cases accumulating in the records of the Registry and, because it was felt that grounds existed for the recognition of a special group of tumours derived from cartilage, chondrosarcoma now receives separate mention in the revised classification (Ewing, 1939).

Lichtenstein and Jaffe regard the view that chondrosarcoma cannot be singled out from the general category of osteogenic sarcoma as untenable. They prefer to distinguish predominantly cartilaginous sarcomas from the sarcomas which have more obviously bone as a parent tissue. Lichtenstein and Jaffe claim that the concept of chondrosarcoma as a separate entity has a firm anatomical and histological

basis and is important clinically and prognostically. They point out that chondrosarcoma is far less common than bone sarcoma and that, whereas most bone sarcomas, apart from those occurring in Paget's disease, arise in youth, chondrosarcoma occurs at a later age. They say that as a rule chondrosarcoma runs a much slower course than osteogenic, not metastasising in the lungs for years, while osteogenic sarcoma has often so metastasised at the time of the initial intervention. This is a view which is supported by Willis.

Recognition of Malignancy in Cartilaginous Tumours

As already mentioned, many authorities have stated that it is often difficult or impossible to distinguish benign chondroma from chondrosarcoma. Lichtenstein and Jaffe deny this. They point out that attention should be concentrated upon the cells rather than the intercellular matrix, and claim that by careful search of wide areas of the neoplasm for inconspicuous cytological abnormalities, it is possible to distinguish the malignant cartilage tumours from the benign ones. They say that a tumour of cartilage is not to be regarded as benign if (1) many cells with plump nuclei are to be seen ; (2) more than an occasional cell has two such nuclei ; (3) there are giant cartilage cells with large single or multiple nuclei or with clumps of chromatin. In benign chondroma on the other hand, the component cartilage cells are consistently rather small ; the vast majority have a single nucleus which is not large in relation to the cell as a whole and never consists merely of a clump of chromatin.

As pointed out by Ewing (1940), the active growth and infiltrative properties reside in the undifferentiated cells at the periphery of the cartilage nodules.

Distinction between Chondrosarcoma and Osteogenic Sarcoma Containing Cartilage

According to Lichtenstein and Jaffe the basic difference between chondrosarcoma and osteogenic sarcoma is that the former develops from fully differentiated cartilage while the latter originates from more primitive tissue, the bone-forming mesenchyme. The statement that chondrosarcoma develops from fully differentiated cartilage is open to misinterpretation. Bone may in development be formed from primitive mesenchyme cells in two ways, directly as in the case of membrane bone, or indirectly as in the case of bones preformed in cartilage. It is probable that this statement of Lichtenstein and Jaffe is intended to convey the idea that whereas

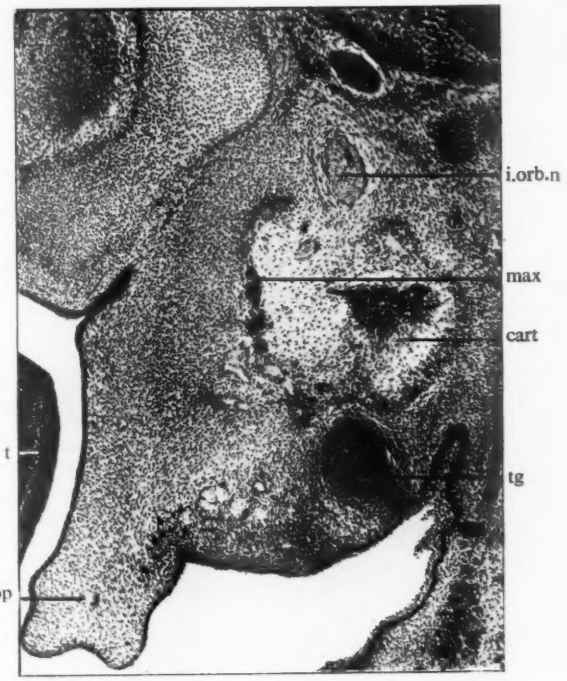

Fig. 3.—Coronal section through the maxillary region of 30 mm. human embryo, showing mass of cartilage, part of which has calcified, in the maxilla. Stained hæmatoxylin and eosin. × 60. cart. cartilage mass which has calcified at its centre. pp. palatine process ; i.orb.n. infra-orbital nerve ; t. tongue ; max. bone of maxilla ; tg. tooth germ.

osteogenic sarcoma may be regarded as having as its parent cell the primitive mesenchyme cell which has the potentiality of forming bone directly, chondrosarcoma develops from a less primitive cell which is only able to form bone indirectly from cartilage.

The following is a slightly condensed quotation from the paper of Lichtenstein and Jaffe :

" Ordinarily in an osteogenic sarcoma most of the proliferating connective tissue, which may be quite anaplastic, becomes converted into osteoid or bone directly, although it usually also forms some cartilage which in turn tends to undergo calcification and ossification, and occasionally such cartilage may be a predominant feature of the histology. However, in such a case, if the examination is not limited to a small field, in places the basic proliferating connective tissue merges directly into bone or osteoid. On the other hand, in a chondrosarcoma, although areas of the cartilage may become calcified or ossified, bone or osteoid will never be seen evolving directly from a sarcomatous stroma."

FIG. 4.—" Chondroid bone." Bone having some of the characteristics of cartilage. From the maxilla of a 60 mm. human embryo, in the region of the deciduous canine tooth germ. Stained hæmatoxylin and eosin. × 185.

Lichtenstein and Jaffe's view may perhaps be briefly expressed diagrammatically thus :

Osteosarcoma

Primitive mesenchyme → Bone
Primitive mesenchyme → Cartilage → Bone

Chondrosarcoma

Less primitive mesenchyme → Cartilage → Bone

CASE REPORTS

It is appropriate at this stage to present the two cases which have been studied personally.

Case A

A married woman, aged 47 years, presented herself on 8.6.48 complaining of a painful swelling on the gum. It had first appeared six weeks before and had increased rapidly in size. Her doctor had lanced it and she had applied undiluted Dettol to it several times. The day before her appearance at hospital the swelling had burst and discharged blood-stained pus followed by some profuse hæmorrhage.

On examination the swelling was found to consist of a rounded elongated mass about the size of a walnut, attached to the gum buccal to 421 |, 53 | being missing. The diameter of the swelling was slightly larger than that of its attachment to the gum. The greater part was firm in texture and pink in colour but at its centre the mass was yellow and necrotic. There was no marked tenderness but 4 | was slightly tender to percussion and loose. Radiographs showed no changes in the bone below, and no opacity of the antrum.

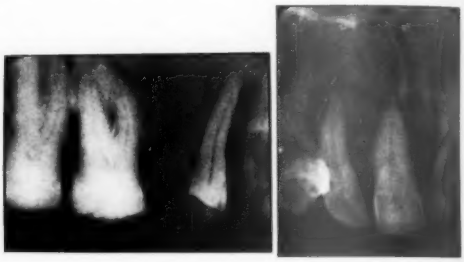

FIG. 5.—*Case A.* Radiographs of 76421 |. No evidence of bone destruction.

It was felt that the general appearance of the swelling resembled that of a fibrous epulis which had ulcerated, in this case perhaps due to trauma or to the application of antiseptic. However, the rapidity of growth suggested a more grave condition.

When biopsy was performed it was noted that the mass was extremely resistant to the knife. The pathological report made by Dr. J. F. Smith indicated ulcerating chondrosarcoma.

In consultation with Dr. F. Ellis of the London Hospital Radiotherapy Department, it was decided, in view of the apparently localised situation of the tumour and the fact that, generally speaking, the malignancy of chondrosarcoma is not high, that a good result might be obtained by local excision followed by deep X-ray therapy.

After a pre-operative dose of X-rays, the tumour, with the adjacent mucosa to a width of 1 cm., was excised on 26.6.48. A considerable amount of the underlying bone was removed together with 6421 |. The margins of the wound were brought together as far as possible with sutures. Fourteen days later the area of bare bone had become covered with granulation tissue and deep X-ray therapy was started.

Four months after the operation a recurrence was suspected and radium treatment was applied. One month later it became obvious that there was extensive recurrence and the area was explored by diathermy. The tumour was found to have destroyed the floor of the antrum and the outer wall of the nose. Radium tubes were inserted. A number of sequestra separated during the weeks that followed

and on 27.1.49, in order to relieve the severe pain from which she was suffering, right trigeminal nerve root resection was performed by Mr. D. W. C. Northfield.

Further deep X-ray therapy was of little avail and on 21.4.49 a last attempt was made by Mr. C. Keogh to destroy the growth by diathermic coagulation, but its extent was found to be too great. A lymph node of the left upper deep cervical group could be palpated and was getting larger.

Her general condition became very poor and on 3.5.49, when the chest was X-rayed, there was a left pleural effusion and a mass in the right hilar region. On 14.5.49 the patient died of bronchopneumonia. Autopsy was refused.

Pathological Report (*Case A*)

The cut surface of the tumour removed at operation was slightly granular and greyish-white in colour. A small mass of tissue was attached to the root of 4|. Histologically the tumour mass was composed of large and small masses of hyaline cartilage separated by a vascular and highly cellular connective tissue (fig. 6). The cartilage cells are irregularly distributed in the cartilage matrix and irregular in size, some being extremely large. Most of the cartilage cells have a very large round or oval granular nucleus and many have two nuclei. Here and there the nuclei are small and angular and stain deeply with hæmatoxylin. At the centre of the larger masses of cartilage the cells have shrunken away from the cartilage matrix that surrounds them and the nuclei are vacuolated. In places the matrix is calcified and stains with hæmatoxylin and there are calcified areas which resemble non-lamellar bone.

The cells of the highly cellular tissue between the masses of cartilage are large with plenty of cytoplasm and most possess several thick processes. The nuclei are very large and round with prominent nucleoli and a prominent chromatin network, but cells with deep staining, angular, bizarre nuclei, often two to each cell, are quite common. At the periphery of the cartilage masses the cells are grouped particularly thickly as can be seen in fig. 6. The cells of this soft tissue between the cartilage masses appear to be a primitive type of fibroblast.

In some situations the histology is frankly that of a fibrosarcoma, while in others the cells seem to lie in spaces in a faintly granular or fibrillar eosinophil matrix so that the general appearance is suggestive of cartilage of which the intercellular matrix has not formed properly (fig. 7). Nowhere is tumour tissue being converted directly into bone.

The soft tissue attached to 4| proved to be a small mass of the neoplasm occupying a wide area of resorption (fig. 6).

Case B

A man, aged 51 years, presented himself in October 1943 complaining of a painless swelling in 1| region. Although he had a vague recollection of noticing a swelling in this situation twelve months

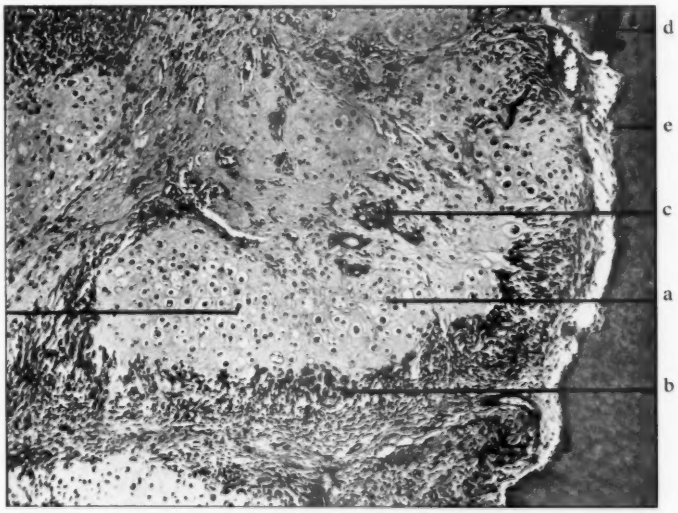

FIG. 6.—*Case A*. Section of tissue attached to root of 4|. Stained hæmatoxylin and eosin. × 60. Mass of cartilage with enormous cartilage cells and nuclei. a. binuclear cells ; b. cells laying down cartilage matrix ; c. areas in which the matrix is calcified ; d. cementum ; e. resorbed surface of dentine.

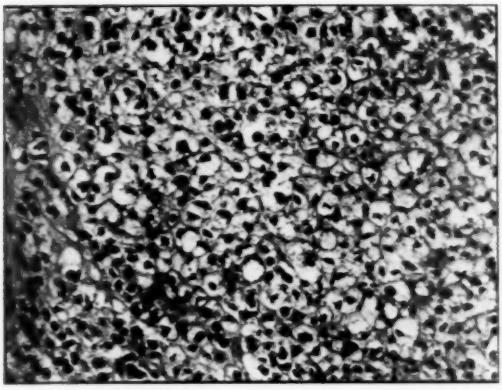

FIG. 7.—*Case A.* High power of a different field in which the tissue, although highly cellular, resembles cartilage to some extent. Nuclei of very irregular size and of bizarre shapes, in some cases more than one to a cell. Stained hæmatoxylin and eosin. × 150.

previously, his attention was first directed to it one month previously when 1| became very loose and fell out. Since then the swelling had rapidly increased in size.

On examination 765432 | 1234578 were found to be present in the upper jaw. The swelling, which was smoothly rounded and hard, extended on the palatal aspect from the mid-line behind 1 | socket to the premolars of the right side, and bulged into the vestibule over the socket of 1 |, and the roots of 32 |. The mucous membrane was freely movable over it and the swelling was not tender except to heavy pressure. A hard lump could be felt within the socket of 1 |, and 432 | were slightly loose. Radiographs (fig. 8) showed a diffuse rather patchy radiopacity in the region of the swelling and the roots of 432 | were resorbed and surrounded immediately by an irregular zone of rarefaction. The Wassermann reaction was negative and there was no involvement of lymph nodes. Under general anæsthesia, the mucous membrane was reflected and some of the mass, which was composed partly of tissue resembling cancellous bone and partly of tissue resembling granulation tissue, was chiselled away. The pathological report on the tissue removed was " osteochondroma of the hard palate. No definite evidence of sarcoma but focally rather rich in cells, so a watch should be kept for possible recurrence " (Dr. W. W. Woods).

Three months later (January 1944) the swelling had increased in size and was causing some facial deformity and obstruction to nasal respiration on that side. Radiographs showed that the right maxillary antrum was encroached upon. On the

FIG. 8.—*Case B.* Radiographs of 65432 | showing increased bone density and rarefaction about the roots of 43 | and resorption of the roots.

advice of Dr. F. Ellis a course of deep X-ray therapy was given and the mass became smaller in size and nasal potency was restored. A sinus, through which some necrotic bone was discharged, appeared in the palate.

By May 1944 most of the infection had cleared up and resection of the affected part of the maxilla was performed by Mr.W. M. Mollison using the diathermy knife. The tissue removed, which included 5432 |, resembled vascular spongy bone. The antrum was exposed during the operation and was found to be empty of the growth. It was found possible to close the opening into the antrum and 76 | were left undisturbed. During the months that followed healing progressed uneventfully with no persistent opening into the antrum.

Ten months later (March 1945) there was evidence of recurrence and, after some tissue had been removed by diathermy, radon seeds were inserted. The tissue removed proved to be chondrosarcoma.

In January 1946 the cavity appeared to be free of recurrence and, although there was still some trouble with necrosis and infection, a denture was constructed.

Three months later, however, a fleshy mass appeared in the cavity, and after this and more of the maxilla had been removed, radium needles were implanted. In spite of this, the tumour was obviously progressing and the patient's general condition worsened. In April 1947 a further attempt was made to eradicate it by diathermy and the application of radium needles in sorbo rubber inserted into the cavity. This was followed by a period during which bone sequestrated and a further application of radium in September 1947.

In March 1948 the patient died at home after having become comatose with blindness of the right eye and left hemiplegia, presumably due to extension either of the tumour or of sepsis into the cranial cavity. Autopsy was not performed.

Pathological Report (*Case B*)

As in Case A the tumour was composed of masses of hyaline cartilage separated by connective tissue. The cartilage cells conform to no pattern within the matrix and most of them are very large, but on the whole the nuclei are smaller than in Case A and binuclear cells are more sparse. More of the cartilage matrix is calcified, although in places this consists merely of calcareous dust. In some of the cartilage masses cystic spaces occur here and there, while in the soft tissue between the masses are rounded spaces filled with blood or eosinophilic structureless material. These may represent areas where the cartilage has degenerated completely (fig. 9).

The connective tissue between the masses of cartilage is on the whole less cellular and less anaplastic than that in Case A. Nevertheless the nuclei are very irregular in size and shape and although cells in mitosis are few, some cells are binuclear. Most of

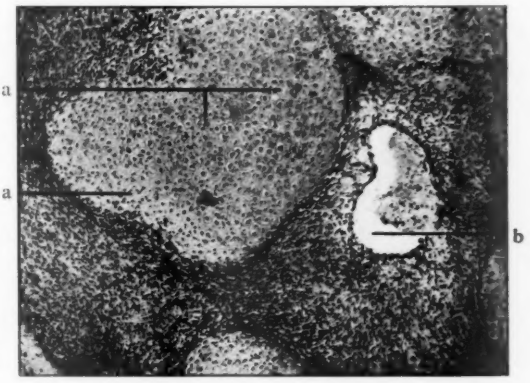

FIG. 9.—*Case B.* Section of tumour mass. Islands of cartilage in a stroma of highly cellular connective tissue. Irregularly arranged cartilage cells, some very large and many with double nuclei. Nuclei irregular in size and shape. Stained hæmatoxylin and eosin. × 46. a. binuclear cells; b. space within stroma containing debris and blood cells. No endothelial wall. Probably an area of degenerated cartilage.

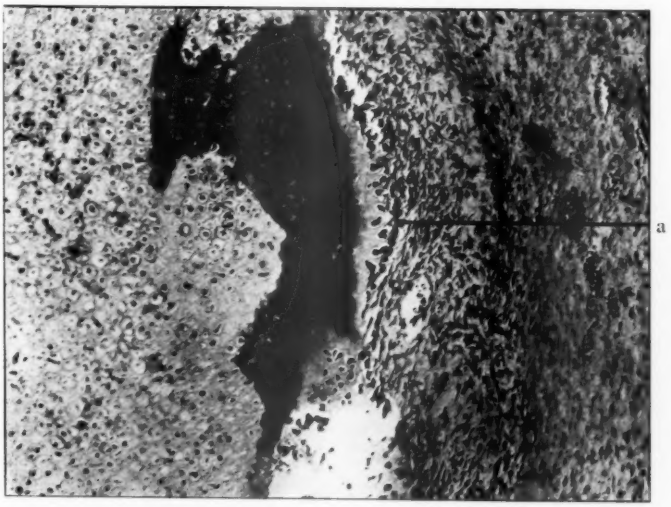

FIG. 10.—*Case B.* Mass of cartilage undergoing calcification. Hæmatoxylin and eosin. × 85. a. cells of stroma laying down matrix which in this situation is eosinophil and fibrillar and resembles osteoid.

the nuclei have two large prominent nucleoli. In some situations, as in fig. 10, the cells form a layer closely in apposition to the periphery of the cartilage, and various stages can be seen of their gradual inclusion in the matrix being laid down. As in Case A, no areas can be found in which it could be said with certainty that tumour tissue is being converted directly into bone. There are a few areas of typical sarcomatous spindle cells.

Where the cartilage matrix is calcified some areas closely resemble non-lamellar bone and there are a few fragments of lamellar bone with a distinct mosaic pattern (figs. 11 and 12). Although these fragments are surrounded intimately by calcified neoplastic cartilage which appears to be continuous with their structure, they probably represent remains of the original bone of the jaw.

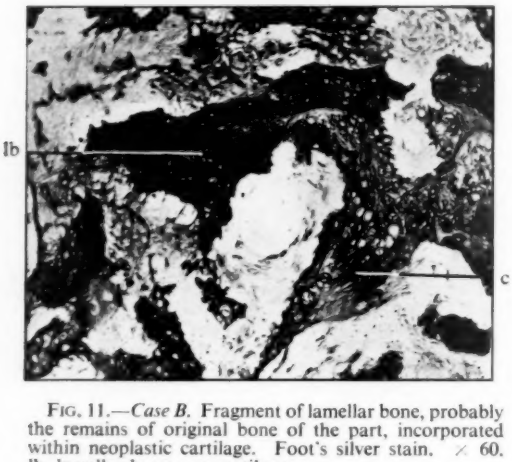

FIG. 11.—*Case B.* Fragment of lamellar bone, probably the remains of original bone of the part, incorporated within neoplastic cartilage. Foot's silver stain. ⁄ 60. lb. lamellar bone ; c. cartilage.

FIG. 12.—*Case B.* Fragment of lamellar bone showing evidence of lacunar resorption and deposition of calcified neoplastic cartilage on its surface. Stained hæmatoxylin and eosin. ⁄ 165. lb. lamellar bone ; c. calcified cartilage.

COMMENTS

One of the interesting features of Case A is the fact that, although the bone in the region of the original swelling appeared radiographically to be not involved, it was in fact invaded by the neoplasm, as was shown by finding tumour tissue attached to the root of $\overline{4}|$. In this respect the radiograph was very misleading and had the true state of affairs been realised, i.e. that the neoplasm was not confined to the extra-bony swelling, no doubt a much more radical excision would have been undertaken.

It is difficult to explain the radiographic finding. The tissue of a chondrosarcoma is, of course, relatively radiolucent unless much calcification has occurred. It is difficult to believe that even a tumour mass containing many islands of calcified cartilage or bone could produce a shadow simulating so closely the normal X-ray pattern of bone. The small mass found on the palatal aspect of $\overline{4}|$ could have been an isolated outlying extension of the neoplasm growing alongside the root. A small area of rarefaction in that situation would be obscured by the superimposed shadow of the root of the tooth. Willis (p. 137) has pointed out that radiographically normal appearances may be seen in bones containing heavy metastatic growth. In such a bone, the tumour infiltrates the marrow spaces only and leaves the trabeculæ intact.

The histology of Case B suggested a lower degree of malignancy than Case A, and this was borne out to some extent by the clinical behaviour.

The statement made by Lichtenstein and Jaffe that osteosarcoma and chondrosarcoma can be distinguished by the fact that in the former bone and osteoid evolve directly from the sarcomatous stroma whereas in chondrosarcoma this is never seen, and where bone is formed it is always by the ossification of cartilage, is attractive in its simplicity. In practice, however, this criterion is not so easy to apply because in the case of the atypical tissues formed by neoplasms the distinction between calcified cartilage and bone is not always clearly defined. For instance in the field shown in fig. 10, although the greater part of the mass is undoubtedly cartilage, the uncalcified tissue being formed at "a" closely resembles osteoid. The intercellular matrix is eosinophil and of fibrillar structure, but, according to Maximow and Bloom (1949), in the very early stages of cartilage formation

collagen fibres are present in the intercellular substance which is at first eosinophil and then soon develops into the basophil homogeneous substance characteristic of cartilage.

Neither case responded well to irradiation although in Case B the tumour mass did at one time diminish considerably in size following a course of deep X-ray therapy.

Unfortunately autopsy was refused in both cases so that it is not possible to say with certainty that in Case B there were no metastasis nor in Case A to determine whether the enlarged cervical lymph node and radiographic opacity in the lung were metastases.

Age Incidence

Sarcomas are usually regarded as being most common in young subjects. Christensen (1925), however, in reviewing 1,000 cases of malignant tumours of bone, 15 of which affected the jaws, found that 33 per cent occurred after 30 years.

Geschickter and Copeland (1949) state that 14–21 years is the commonest age for chondrosarcoma.

Lichtenstein and Jaffe, and Willis state that the great majority of chondrosarcomas occur between the ages of 30 and 50 years. This appears to be borne out by the present series of cases included in Table I, but the numbers are, of course, too few upon which to base an opinion. It is clear, however, that chondrosarcoma is not by any means confined to the young.

Malignancy

There appears to be some diversity of opinion regarding the degree of malignancy exhibited by

TABLE I

Reported by	*Age*	*Sex*	*History*	*Diagnosis*	*Treatment*	*Final course*	
Roper-Hall and Adcock (1939)	51	F	Hard swelling in 321| region, sclerosis of underlying bone. Excised; recurrence 2 years later extending to floor of nose. Excised. Deep X-ray therapy	Chondrosarcoma	Excision and deep X-ray	?	Original swelling reported diffuse chondroma
Registry of Dental and Oral Pathology (1944)	40	M	Small tumour removed from maxillary gum. Opacity of antrum and ethmoid	Chondrosarcoma. Full histological details	?	?	
Ringertz (1938)	29	F	Hard swelling in upper incisor region. Rapid increase in size. At operation whole alveolar process involved but antrum free. Rapid recurrence	? chondrosarcoma	Excision and radium	Death 3 years after onset, with lung metastasis. Free of local recurrence	Reported as osteosarcoma
Miles Case A	47	F	Swelling on gum 4321| region. Bone involved but antrum clear. Local excision and deep X-ray. Further operations and irradiation for extensive local recurrence	Chondrosarcoma	Repeated excision, deep X-rays and radium	Death 1 year after onset	? metastasis in lung and regional lymph node
Miles Case B	51	M	Expansion of bone 4321| region. Extensive recurrence after excision. Treated by irradiation and excision	Chondrosarcoma	Repeated excision, deep X-ray, radon seeds and radium	Death from local invasion 4½ years after onset	
Hofman (1926)	56	M	Small tumour removed from lateral wall of nose. Recurrence 2 years later. Ulcerated mass in antrum and palate involved from above	Chondrosarcoma. No histological details	Resection of maxilla and radium	No sign or recurrence 7 months later	Original nasal swelling reported myxochondroma
Harmer (1935)	31	F	Massive growth blocking nasal cavity. Recurrence after excision. Debilitated by sepsis and hæmorrhage. Insertion of radium followed by rapid recovery	Chondrosarcoma. No histological details	Excision and radium	Well 10 years later	Maxillary growth removed at 12 years of which this is considered to be recurrence
Mollison (1916)	19	F	Swelling of cheek and proptosis. Radiographic opacity of antro-ethmoidal region	Chondrosarcoma. No histological details	Excision	Recurrence and death in few weeks	

chondrosarcoma. On the one hand, we have statements, such as that of Germain (1908), " myxochondrosarcoma of the maxillary antrum is not very malignant and can be cured by local excision, and is not usually followed by recurrence." Even Lichtenstein and Jaffe, who have gone to so much trouble to separate benign chondroma from chondrosarcoma, say that, if left to themselves, chondrosarcomas are likely to remain only locally invasive for years.

On the other hand, a number of writers state that these tumours have a special capacity to invade veins and so to give rise to lung metastases. This statement is made by Ewing (1940) who states also that in some cases the metastases have been composed entirely of the undifferentiated connective tissue cells found between the islands of cartilage. This was so in the case described by Ringertz to which reference has already been made.

References to a tendency on the part of chondrosarcoma to invade veins are possibly due to over-emphasis of the significance of a few remarkable cases, quoted by Willis (p. 677), in which the tumour had grown into a large vein and had, by intravascular growth, extended for some distance along the lumen of the vessel, without adhering to it.

Definite evidence that chondrosarcomas in general exhibit less malignancy than other types of bone sarcoma is provided by Macdonald and Budd (1943), who found that of 118 five-year cures of sarcoma, 11·8 per cent were osteosarcomas and 47·5 per cent were chondrosarcomas. These were cases treated by amputation and were probably tumours affecting the limbs. The significance of the figures is enhanced if it is borne in mind that chondrosarcoma is much less common than osteosarcoma.

Treatment

Ewing (1940) says chondrosarcomas are very refractory to all methods of treatment. Lichtenstein and Jaffe, basing their opinion on 15 cases, none of which was in the jaws, say that the only form of therapy which offers any prospect of cure is surgery. They say irradiation therapy is hardly of any value and can serve at most as a palliative agent for a chondrosarcoma in a site inaccessible to surgical intervention.

Ralston Paterson (1948) divides sarcomas sharply into sensitive and insensitive groups. Those which are related to the formed elements of connective tissues such as bone and fibrous tissue constitute the resistant group and retain that character even when the histological picture is one of complete dedifferentiation. The resistant group includes the osteo- and chondrosarcomas and he says further, that there is no difference in radiosensitivity between the various histological types of sarcomas included within the group. The sensitive group is composed of those sarcomas derived from undifferentiated mesenchymal tissue known as the reticulo-endothelial system, that is sarcomas derived from lymph nodes, the liver and bone-marrow, etc.

In 6 of the 8 cases under review irradiation therapy was used, either as an adjunct to surgery or following the surgical preparation of the field for irradiation.

Although in the other cases the termination may have been delayed, in only one case did irradiation produce a complete cure. This is the case described by Harmer (1935) which is noteworthy because, although the disease was well advanced, much sepsis was present and the patient's general condition had deteriorated, insertion of radium needles was followed by rapid disappearance of the growth, and there was no evidence of recurrence during a ten-year follow-up period.

In the face of this case, although a solitary one, it would be unwise to say dogmatically that these tumours as a whole are insensitive to irradiation. The number of cases is, of course, too small to draw any conclusions on this point. Before doing so it would be necessary in any case to take into consideration the technique and dosage of irradiation used in each case, which is beyond the competency of the writer.

Lichtenstein and Jaffe state that there had been a tendency to " underdiagnose " in their 15 cases of chondrosarcoma. Should the benignity of a cartilaginous tumour be in doubt it is probably safest to follow the advice of Cahn (1941), and assume that it is malignant and treat it accordingly.

In view of the fairly general opinion, which is supported by the cases at present under review, and in particular by my two personal cases, that chondrosarcomas are not sensitive to irradiation, it would appear that the method of choice, at least in early cases, is surgery of as radical a nature as possible.

Summary

(1) The literature has been examined for cases of chondrosarcoma of the maxilla and six cases, one of which was originally reported as a case of osteogenic sarcoma, are reviewed, together with two cases of chondroma which arose from the alveolar portion of the maxilla.

(2) The possible sources of vestigial rests of cartilage in the maxilla are considered.

(3) Two fatal cases of chondrosarcoma which

appeared to have arisen from the alveolar portion of the maxilla are presented, and the misleading radiographic appearances present in one of them are discussed.

(4) The views of various authorities on the classification of sarcomas in which cartilage forms a predominant component, and on the recognition of histological evidence of malignancy in such tumours, are considered.

(5) The age incidence, general behaviour, and treatment of chondrosarcoma of the maxilla is considered.

ACKNOWLEDGMENTS

I am indebted to Professor J. D. Boyd of the Anatomy Department, London Hospital Medical College, for granting access to serial sections of human embryos, and to Dr. A. d'A. Bellairs of that Department for much helpful advice regarding the embryological aspects of this paper. Thanks are also due to Mr. A. G. Allen for permission to make use of Case B and to Mr. John King for his photomicrography.

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IMPROVEMENTS IN ELECTRO-FORMING DENTAL DIES

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INTRODUCTION

THE increasing demands on the exactness of dental restorations have led to the modern refined techniques with their use of controlled and self-compensating materials at nearly every stage of a complex casting procedure. It is not surprising, therefore, that interest is growing in another of the fundamental steps of inlay and crown techniques, namely, the production of a die that represents an exact copy of the original tooth which is to be restored.

As none of the materials commonly used for making inlay dies has been entirely satisfactory, the process of producing dies by electro-forming has recently gained favour.

Ordinary impression compounds can be copper plated without difficulty and the results will be models which are of the greatest accuracy and show a faithful reproduction of all detail. A particular technique is described, which has given consistent results and eliminates certain difficulties which have caused a number of workers to abandon an otherwise suitable method.

While it is exceedingly simple to assemble an experimental outfit for copper plating, it is advisable, for continual use in the laboratory, to construct a more permanent device, which is reliable and will not give trouble during constant use.

Basically, all that is required is a suitable container with electrolyte and a piece of copper sheet, a means of immersing the impression which is to be plated, any source of direct current at about 1 or 2 volts, a variable resistance, which will enable the current to be regulated, and a galvanometer to measure the flowing current.

MEASUREMENT OF CURRENT

Ten to fifteen amps. per square foot is generally recommended as the optimum current density for dental electro-forming [1, 2] and

50 ma. is estimated as the correct current for an "average" inlay impression [2]. Tylman [3] recommends a current of 50 ma. for the first twenty minutes, which can then be increased to 100 ma. for eight to ten hours. Natt [4] uses 25 ma. initially and increases the current to 100 ma. for twelve hours, once the impression is completely covered. More recently Novak [5] has suggested "doubling the number of the copper band used, i.e. to use 15 ma. for a bicuspid band No. 7 or 8, 30 ma. for a molar band No. 15, 10 ma. for an anterior band No. 5 and plating for four hours."

In order to attain a higher degree of standardisation and also to make allowance for the variable resistances encountered with widely different surface-areas, an indirect method of measuring current-densities was tried and has been found very much simpler to operate. According to Smith [6] and following a suggestion of Benson [7]—since current densities are, under certain conditions, directly proportional to the potential drop (under load) between anode and cathode, measured in volts—one can maintain a constant current density of say 15 amps per square foot, quite irrespective of the number and size of the articles to be plated, if, with a variable rheostat a certain constant voltage drop is maintained between anode and cathode.

Metallisation

Three methods are available :

(i) The chemical (wet) deposition of silver.

(ii) The dry application of copper dust or other metal powders to either a dry or an oiled impression surface.

(iii) The production of a graphite film.

After much experimenting the first was excluded as being too complicated and uncertain. It was considered that the second suffered from a number of disadvantages, the most important of which was loss of fine detail.

The best and most consistent results were obtained by using commercial preparations of colloidal graphite in water ("Aquadag").

Before discussing this method in greater detail, brief mention is made of the use of a special impression composition, which was suggested by G. E. Thompson [8]. This composition consists of 60 parts of colloidal graphite and 40 parts of paraffin wax and it is claimed to facilitate electro-plating by virtue of its conductivity.

It will be appreciated that impression compositions, in order to be suitable for inlay work, must fulfil quite stringent requirements with respect to flow, freedom from warpage, softening range and cooling period, accuracy of reproduction, etc., and it would seem quite remarkable if the graphite composition mentioned above happened to meet all these demands. A modified and complex formula was published by Frankel [9] recently and the new composition may more nearly fulfil the requirements. The writer has not so far found the new material easier to manipulate than ordinary impression compounds and can see no great advantage in its use.

The amount of colloidal graphite painted over the impression surface influences the ultimate accuracy of the inlay and this factor must first be discussed.

The writer is indebted, for thickness determinations of thin graphite films, to Messrs. Acheson Colloids Ltd., London, who estimated the average thickness of such films to range from 1 to 3 microns.

An inlay may be considered "a good fit" if the deviation from the cavity in any direction is less than the average size of cement particles in the cement mixture to be employed for fixation. This size has been estimated by Gillett and Irving [10] as 25 microns for an average first-rate cement and 10 microns for a particularly fine-grade product made for experimental purposes. Therefore, it would seem to be of a higher order altogether than that of graphite films, and no fears need arise about loss of accuracy through using colloidal graphite on inlay impressions.

Technique.—Use a stiff, good sable-brush and spread a fair excess of undiluted "Dag" over the impression surface, including the margin of the copper band.

Work the graphite well into the deeper portions of the impression and remove excess material before the film begins to dry. Although a dry graphite film appears to have formed in a few minutes, the impression should be allowed to stand in a dust-free atmosphere for one hour before proceeding further.

Although graphite films are sufficiently conductive to produce electro-formed dies, "oxidising" the surface with "iron filings" is recommended.

Reduced iron, B.P., is applied to the dry graphite film. A sufficient amount will adhere if the powder is just tipped into the copper band impression and then gently tipped out again. The impression can then be mounted on an electrode-holder and boxed in with pink base-plate wax.

The iron powder is turned into copper particles as the boxed impression is filled with electrolyte by means of a glass pipette. On removing

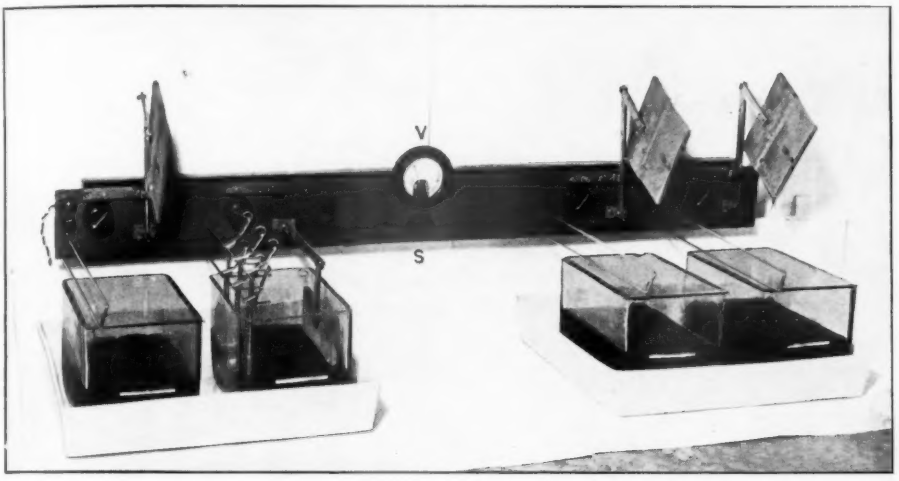

FIG. 1.—Plating apparatus. V—Voltmeter. S—Switch for meter.

the liquid a faint "sheen" of copper will be apparent on most parts of the graphited surface. The impression is rinsed in a basin of water, and transferred to the plating apparatus.

APPARATUS

The following principles were made the basis of construction :

(*a*) All parts which would unavoidably come into contact with corrosive liquids to be completely corrosion-proof. Glass, earthenware and stainless steel are the best materials.

(*b*) All other electrical equipment to be far enough from the plating tanks to avoid corrosion of wires by spilled liquid or crystals creeping along the bus-bars.

(*c*) That part of the electrical equipment which supplies the working current (and which is connected to the A.C. mains) to be completely out of reach of the operator—for safety.

(*d*) Temporary connections should be under adequate pressure. Hence the use of an impression holder with a spring clip and sturdy support for the anode.

Description of Plating Apparatus.—Two earthenware developing dishes (12 in. × 10 in.) contain two glass tanks each (7 in. × 5 in. × 5 in.), which may be covered by a piece of glass, when not in use, in order to prevent evaporation of liquid. A level mark is painted on each tank and the electrolyte is periodically replenished with tap water. The distributing panel made of Paxolin sheet (36 in. × 3½ in.) (figs. 1, 2) shows the control-knobs (fig. 2, R) which operate a set of 4 variable resistances (100 Ω each), one for

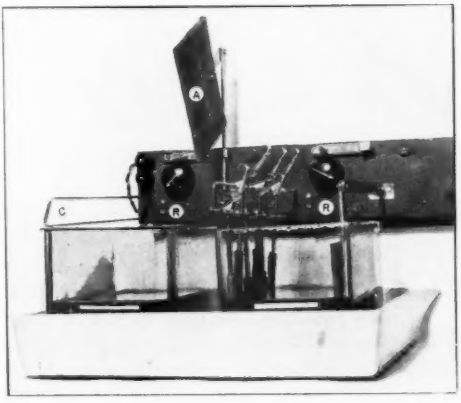

FIG. 2.—Another view of part of fig. 1. A—Anode. C—Cathode. R—Rheostat controls.

each tank and in the centre a voltmeter (one-volt-full-scale-deflection) (fig. 1, V). A meter of this description is not readily available but can quite easily be made by connecting a 1000 Ω fixed resistance in series with a one-ma. full-scale deflection meter.[1] A multiple switch is used to connect the meter to any one of the four circuits as required (fig. 1, S).

From the panel are suspended four copper-anode plates (fig. 2, A). The anode holders are

[1] This calculation neglects the resistance of the meter itself, which may be somewhere between 30 Ω and 150 Ω. For accurate measurements it would be necessary to add a suitable resistance to make a *total* of 1,000 Ω, and the size of this fixed resistance can be found by comparison with a standard voltmeter.

made from two pieces (7 in. and $3\frac{1}{2}$ in. long respectively) of stainless steel bar (1 in. $\times \frac{1}{8}$ in.), joined to each other by rivets and to the copper by stainless steel screws. When the apparatus is not in use, each anode can be lifted out of the plating tank and folded back against the panel. A suitable bolt secures it in this position. U-shaped bus-bars are bent from $\frac{1}{8}$ in. stainless steel wire and fixed to the panel (fig. 2, C). The connections in the back of the panel are shown in the wiring diagram (fig. 3).

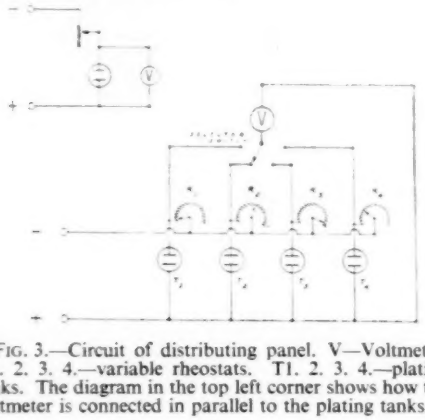

FIG. 3.—Circuit of distributing panel. V—Voltmeter. R1. 2. 3. 4.—variable rheostats. T1. 2. 3. 4.—plating tanks. The diagram in the top left corner shows how the voltmeter is connected in parallel to the plating tanks.

The source of current is a transformer-rectifier combination, which should have a high enough rating for the anticipated maximum current (50 ma. for the average impression : 2 amps for 40 impressions) and which must have a terminal voltage of just under one volt. This necessitates a transformer output of about 2 volts due to the voltage drop in the rectifier. To arrive at the necessary terminal voltage of one volt, which will be registered on the voltmeter, whenever the plating process is momentarily interrupted, a few experiments with the actual transformer and rectifier are required. Either a "bridge" circuit (fig. 4) or so-called full-wave rectification (fig. 5) may be used and 6 volt metal rectifiers have been found quite serviceable. Further adjustments can be made by varying the tappings on the input side of the transformer (e.g. if the mains voltage is 230 volts, the final voltage can be decreased by using 250 volt tapping instead of the 230 v., etc.). Having adjusted the unit for the correct voltage, the output may be too small, as indicated by too small a voltage under load. This can be remedied by either installing a larger rectifier (or placing a second one in parallel with the first) or by changing the "bridge" to a "full

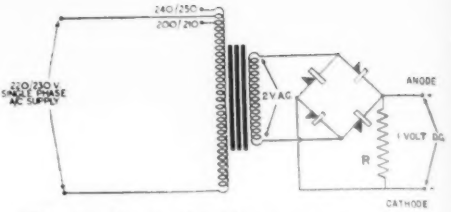

FIG. 4.—Circuit of bridge-connected rectifier.

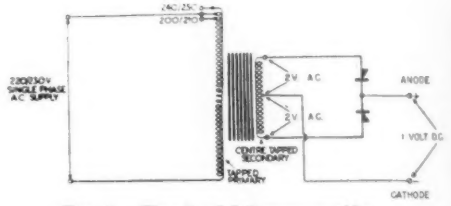

FIG. 5.—Circuit of full-wave rectifier.

wave" rectifier, or by increasing the terminal voltage to say 1·5 volts and then reducing this by a permanent shunt of suitable resistance (about 20–30 Ω), until the voltage on the panel is reduced again to just under one volt (R in fig. 4).

Impression Holder.—A need exists for an efficient appliance, which should have the following properties :

(*a*) Be easy to manipulate.

(*b*) Be adaptable for the various sizes of copper bands used.

(*c*) Not damage an impression through pressure.

(*d*) Be simple to manufacture.

(*e*) Require little or no maintenance.

(*f*) Guarantee good electrical contacts.

(*g*) Resist the corrosive fluids which are used in electro-plating.

Attempts to solve the problem have followed three different lines :

(*a*) To fasten the underside of the impression with sticky wax to some kind of metal platform (as in Hanau's apparatus).

This is reasonably satisfactory, but some skill and experience are required in order to produce good metallic contact between copper band and holder, as the sticky wax may act as an insulator.

(*b*) To wrap or twist a wire around the side of the band.

This method has the faults of most improvisations : New wire, i.e. expendable material, must be provided all the time. This wire must still be connected to the rest of the apparatus, usually by means of set-screws.

(*c*) To use a "snare" or loop of variable size to engage the band [1].

It was thought that the last method was capable of further development and the impression holder to be described presently is the direct result of Ellis's suggestion. It was soon obvious that the loop itself was undergoing considerable strain in use and that, while it must be very flexible and adaptable, it should yet be made of a shape and material which could be subjected to repeated bending without breaking. As it must also resist corrosion, soft stainless steel seemed the most suitable material, and band or tape much better than wire. It is an advantage if the actual piece of steel-tape is easily detachable from the rest of the holder and replaceable loops of soft stainless steel tape 2·5 × ·15 mm., 3 in. long, were made, folded at one end and welded on an orthodontic welder (fig. 6, A).

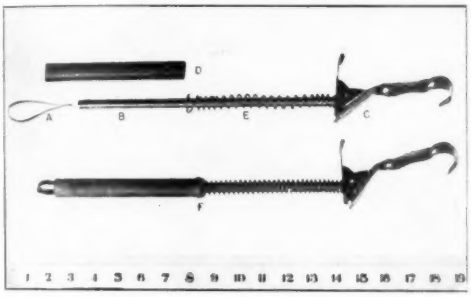

FIG. 6.—Impression holder. A—Stainless steel loop. B—Stainless steel rod. C—Clip. D—"Laminac" tube. E—Spring. F—Assembled holder.

Stainless steel rods ($\frac{1}{8}$ in. diameter, 4 in. long) are slotted about $\frac{1}{4}$ in. deep at one end with a thin "Eclipse" metal saw and after inserting the loop, the resulting slot is closed in a vice (fig. 6, B). The other end of the rod is turned or filed until it can be driven into a 7·64 in. hole, over a width which will allow a good rivet to be made. A hole is drilled into one half of a modified Kodak type X-ray clip (fig. 6, C) (stainless steel). After the rod has been securely riveted in this hole, the clip is reassembled. The beaks of the clip must be ground until they will securely grip a $\frac{1}{8}$ in. rod between them.

For insulation "Laminac" tubing 3/16 in. inside diameter (Mica and Micanite Ltd., London, N.) is cut into pieces 2 in. long (fig. 6, D). Tension springs are made by winding a coil made from 0·7 mm. hard stainless steel wire on a $\frac{1}{8}$ in. rod, preferably on a lathe. About 35 turns are required for one spring and the spring is opened to the required length (fig. 6, E). To assemble the holder, the loop is made to slide into the slot at one end, the spring is forced over both and brought up against the clip and the insulating tube follows last. After the spring has been compressed or extended for correct length, the holder is ready for use (fig. 6, F).

Plating Technique

Cleaning.—Remove all loose particles from the impression surface, using a stiff sable brush. Wipe off any excess of vaseline with cotton-wool pellets. Remove any blood and saliva, either with water alone or with hydrogen peroxide soap solution (1 : 1), followed by water. Dry thoroughly with compressed air.

Mounting.—Connect the copper band to a holder, making a good contact. Mount with the shortest part of the ring uppermost so as to avoid stagnation of liquid of low copper content inside the impression.

Graphiting.—Apply "AQUADAG" (colloidal graphite in water) on a good sable brush (Winsor & Newton No. 4) and cover all parts of the impression surface, including the margin of the copper band, using an excess of material. Remove this excess with the brush, drying the latter repeatedly on a sheet of clean paper. Remove all loose particles, impurities, etc. Allow to dry for forty-five minutes to one hour.

Fill impression with reduced iron and gently tip out again.

Boxing-in.—Wrap a strip of pink base-plate wax once around the band. Make the wax project an even distance of about 2 mm. beyond the margin of the impression. Cover all exposed metal parts, including the wire lead, other than those which are exposed on the actual impression surface.

Connect the tank which you are using to the meter by means of the selector switch.

Covering.—Fill the impression with electrolyte and agitate with a stream of air (chip syringe). Repeat, wash with water and immediately immerse in the plating bath, but avoid trapping air inside the impression. Immerse the copper anode at the same time. Adjust the meter-reading by means of the rheostat to 0·5 volt and maintain this voltage until a complete copper film is deposited on the impression surface. Avoid higher currents, as the resulting dark brown deposit will be crumbly and lead to a faulty die. A faultless copper surface should be produced on the impression within forty-five minutes.

It is advisable not to cover more than one impression at a time in any one tank.

Faults.—Dark patches which refuse to plate. These may be due to :

(*a*) Air-locks (round, regular outline).
(*b*) Localised spots of high resistance (irregular outline).

These may be caused by too low a current or a faulty graphite film (the latter due to carelessness in graphiting, the presence of grease spots or use of too highly diluted "Aquadag").

Remedies.—Fill the impression with methylated spirit, agitate (chip syringe), exchange with water and re-immerse.

If the faults still persist after further plating, retouching will then be necessary (*see below*), as faulty dies will otherwise result.

Plating.—Plate for sixteen hours or more at 0·35 volt. Reduce current over week-ends (0·25). Up to twelve impressions can readily be plated in the same tank.

Backing.—Remove the anode after plating and cover the bath. Remove wax and wash the impression. Dry with compressed air. Back with stone or Kryptex. Mix a small amount on a glass slab with a cement spatula to a very stiff consistency and vibrate the stone into the impression by means of the serrated handle of a Le Cron carver. Back small impressions with Kryptex which should be mixed to a very stiff consistency and packed into the impression with a plastic instrument.

Trimming.—Allow to harden for one hour, separate over a Bunsen flame, immerse in chloroform for cleaning, brush and trim with stones and garnet discs. Gross excess of copper can be removed with a fine fretsaw blade.

Miscellaneous.—"Aquadag" requires dilution with distilled water from time to time. Keep the bottle closed whenever possible to prevent evaporation.

Impressions consisting of composition only (without copper bands) can be plated directly by mounting on wire leads. The ends of the wire strands are exposed and painted with graphite. Care must be taken not to warp the impression when securing the (warm) wires in the composition.

Dowel crown impressions are treated in the usual way, but only plated for three hours. During this time an adequate deposit will have been produced on the dowel and it will then be necessary to re-direct the current into the deeper parts of the impression. A short piece of (cycle-valve) rubber tubing is slipped over the dowel to stop further deposition in this area, and the plating continued overnight in the usual way.

Retouching or "Spotting."—This will be needed occasionally and a copper varnish is used as follows:

Wash and dry the impression. Pour a small amount of copper powder on to a glass slab, then 1–2 drops of shellac varnish (shellac in methylated spirit). Mix. Touch faulty spots sparingly with this paint and allow to dry for several minutes. Wash in water and re-immerse in the plating tank. It is useless to carry out retouching on impressions which have been allowed to plate for any length of time (more than one hour). If spotting is necessary and yet sufficient time cannot be found for it in a given case, it is safe to leave the impression immersed in plain water and continue the process the next day. It has been found that the use of graphite for spotting, as recommended elsewhere [5], causes several layers of deposit to form, with consequent peeling off of the surface in the finished die.

Composition of Electrolyte.

Copper sulphate	(cryst.)	200 grm.
Sulphuric acid	(conc.)	50 grm.
Water		1000 c.c.

Add 2 c.c. of phenol sulphonic acid, obtained by carefully mixing equal parts of liquid phenol (95 per cent) and conc. sulphuric acid and holding at 100° C. for one hour (water bath).

The plating solution usually turns green after it has been in use for some time, but this does not affect its efficiency [11].

Summary

The method of electro-forming inlay dies is reviewed and suggestions are made for :

(1) The standardisation of currents by means of voltmeter control.
(2) A simplified metallisation procedure using a commercial preparation of colloidal graphite in water ("Aquadag").[1]
(3) A reliable plating apparatus requiring a minimum of maintenance.
(4) An efficient impression holder.
(5) A detailed plating technique.

Addendum

A method of electro-forming from hydrocolloid impressions has recently been published in U.S.A. [12], and a report about a method for plating agar-type impression materials, developed by the present writer, is shortly to be published elsewhere [13].

Acknowledgments

The writer wishes to express his gratitude to Mr. R. Cocker for his encouragement and generous

[1] "Dag" and "Aquadag" are the registered trade marks of the manufacturers, Acheson Colloids Limited, London.

guidance and advice; thanks are also due to the Department of Medical Photography at King's College Hospital Medical School, London, for the photographs.

To the Louis Cassier Company Limited for permission to reproduce circuit-diagrams (figs. 4 and 5) from "Handbook of Industrial Electroplating—Ollard and Smith."

To Messrs. Acheson Colloids Ltd., London, for providing material and suggesting technical improvements.

To his colleagues at King's College Hospital Dental School for much valuable help and interest.

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SHORT COMMUNICATION

RE-ERUPTION OF A DECIDUOUS INCISOR

By W. MALCOLM GIBSON, M.B., Ch.B., F.R.F.P.S., L.D.S.

Director of Dental Prosthetics, Glasgow Dental School

On 5.7.49 a child, aged 2 years 1 month, fell against a chair. When examined it was found that the | a had been driven back into the alveolus so that only the incisal edge was to be seen. The gum surrounding the tooth was markedly swollen while the lips were also bruised and swollen. All the other deciduous teeth were fully erupted and the arch showed perfect symmetry. As the child was very fractious it was decided to leave the question of treatment to be settled at the next visit.

Four days later the swelling of the gums and lips had practically disappeared and it was found that the tooth was quite loose in the socket. Radiographs could not be taken as the child would not tolerate the film in her mouth.

Resisting the urge to do "Something," e.g. bring the tooth down and fix it with an acrylic splint, it was decided that the best treatment would be masterly inactivity and to hope that the inactivity would indeed prove to be masterly.

One month later it was found that the tooth was fairly firm in the socket and that it had re-erupted slightly.

When examined on 7.12.49 it was found that the tooth had returned to its normal position in the arch, having completely re-erupted.

The writer suggests that the same treatment might not be inappropriate in similar cases, even when it is a permanent tooth that is involved, provided always that there is no gross damage to the alveolus or to the tooth.

Practical Note

A MODIFIED DESIGN FOR A HIGH-LABIAL RETAINER FOR KENNEDY CLASS I AND II CASES

By K. STRAUSS, L.D.S.Eng.

The conventional design of high-labial elastic retainers, as used for free-ending saddles in Class I and II cases of Kennedy's classification, all appear to suffer from one defect: they are inactive when their retentive properties are needed most. By virtue of their design they are fully active only when the teeth of the saddles are in occlusion with their antagonists and retention is therefore already automatic, whilst they are more or less inactive as soon as the teeth come apart, i.e. just at the very moment when the upper saddle tends to drop and retention is most urgently required. It is immaterial whether the tip of the retainer is round, arrow-headed or of the Roach pattern—in either case it moves away from the abutment tooth when the pressure of the occluding teeth ceases, thus nullifying its purpose. Fig. 1 is intended to show the actual process diagrammatically. Far from being a "retainer," it appears

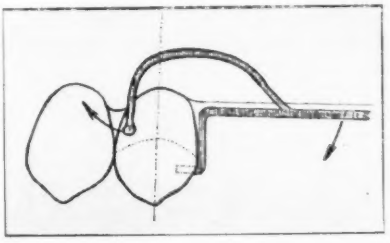

Fig. 1.—Conventionally designed high-labial retainer (diagrammatically). The arrows indicate how the tip of the retainer moves away from the abutment tooth when the free end of the saddle tends to drop.

to be a rather ineffective and—in the front tooth region at least—unsightly adjunct. The only way to render this type of clasp more retentive would be to carry it down into the lower anterior quadrant of the abutment tooth—an impracticable procedure for reasons of function and appearance.

As a solution of the problems involved the present writer ventures to suggest the modification shown in fig. 2. The salient features are:

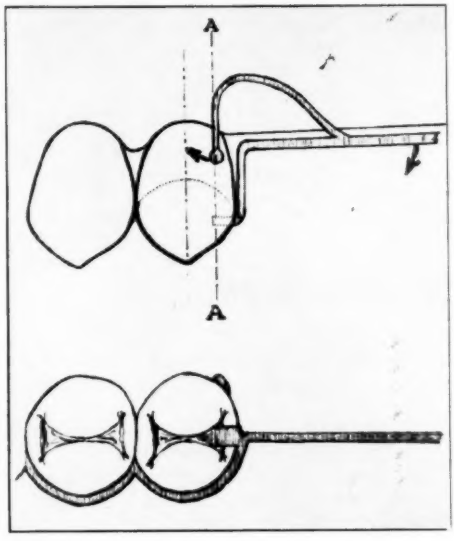

FIG. 2.—The writer's modified design (diagrammatically)—above : buccal aspect ; below : occlusal aspect. The arrows indicate how the tip of the retainer braces itself against the biggest bulge of the abutment tooth when the free end of the saddle tends to drop.

(1) The retainer ends in a round flattened button which contacts the abutment tooth on its buccal surface on a point slightly distal and gingival from the centre of the disto-gingival quadrant ; in other words, slightly above the horizontal and slightly behind the vertical equators of the tooth.

(2) The tip of the retainer is slightly bent, as shown in fig. 3, thus providing a considerable degree of additional, and yet elastic, retention.

From a closer study of fig. 2 it will become apparent what happens when the saddle tends to drop at its free end : the tip of the retainer is thrust forwards and upwards, thus bracing the terminal button against the bucco-distal slope of the abutment tooth. Having, however, been fitted against this slope in the first place, the tip of the retainer cannot give way to this thrust and, consequently, does not allow the saddle to drop at its distal end. Any tendency to drop off vertically, e.g. in bilaterally free-ending cases, such as Kennedy Class I, is effectively prevented by the kink shown in fig. 3.

The retainer is made of No. 6 gauge 17 ct. half-round platinised gold wire, the terminal button consists of a drop of 20 ct. gold solder (fusing point 1,590° F.). The retainer is then cast on to the "Unitor" gold skeleton frame and the joint soldered over. Appropriate heat-treatment completes the process.

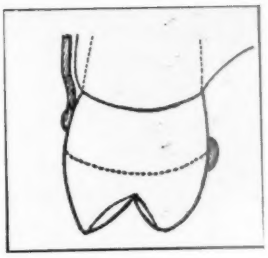

FIG. 3.—Vertical section through the abutment tooth at the centre of the terminal button (A——A in fig. 2), showing the "kink" of the retainer tip near the terminal button (diagrammatically).

It may perhaps be added that this clasp is æsthetically most satisfactory, because the tip is tucked away behind and above the biggest diameters of the abutment tooth. A considerable number of skeletons have been constructed by the present writer in which this retainer was used. The observed results after an extended period of observation may be summarised as follows : the retention appears to be good, the patients are less liable to bend these retainers owing to their reduced spans and the appearance is satisfactory. Fig. 4 shows the retainer in a typical Class I case.

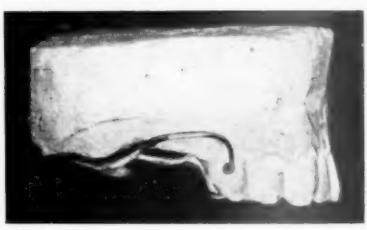

FIG. 4.—Practical application in a Kennedy Class I case.

Orthodontic Note

The Role of Observation and Simple Treatment in the Practice of Orthodontics

OBSERVATION has proved that the amount of treatment that seems necessary at the first examination can often be reduced or entirely eliminated. Oppenheim states that nature should be given enough opportunity and time to perform what we intend to do by the application of stimuli not force. Stimuli alone create the osteoclasts which remove the obstacles to tooth movement. They, not the appliances, are responsible for our results. Appliances are a means to create osteoclasts by stimulation. Adequate psychologic management of the patient gives the operator access to the tremendous power of co-operation and understanding.—SHENAN, H. L. (1950) *Amer. J. Orthodont.*, **36**, 1.

BRITISH DENTAL JOURNAL
MAY 19, 1950

THE SERVICES

BEING able to rely on the services of every newly qualified dentist, who is medically fit, for the term of his National Service, the dental branches of the Armed Forces occupy a privileged position in comparison with other branches of the public service. If this were not the case, and the Forces had been compelled to seek recruits in open competition with private practice and other forms of public service, there would have been a serious decline in the number of dental officers, comparable to that which has taken place in the School Dental Service. Although, however, the Services have been able to maintain a reasonable establishment of junior dental officers serving for the term of their National Service, there are signs that it is becoming increasingly difficult to secure a sufficient number of officers who are prepared to make a career in one of the three Services by accepting long-term Regular Commissions. The full results of any decline in the number of competent senior officers will not be immediately apparent, but it is sufficiently obvious that the consequent narrowing of the field of choice for appointments to the higher administrative posts will, in time, be reflected in a loss of efficiency throughout the Services, which could not be contemplated with equanimity. It would be easy to attribute this falling off in the number of applicants for long service Commissions to the general shortage of dentists in relation to the demand for their services. But, while this is undoubtedly one of the factors, possibly the main one, which must be taken into consideration, it is by no means the only one. It is true that, in the matter of attracting dentists to adopt the Services as a career, the element of competition in a limited market plays an important part. That being the case, it is imperative that the Ministry of Defence should not continue to handicap themselves in their efforts to obtain recruits by maintaining differentiations in pay between medical and dental officers of equivalent rank.

This is an old-standing grievance and the British Dental Association has repeatedly pressed for its removal. The Dental Spens Committee did, in fact, recommend that there were grounds for some differentiation between the earnings of doctors and dentists in private practice who were taking part in a publicly organised health service. They did so, however, on the ground that a doctor was on duty for longer hours than a dentist, and that "his actual leisure is very substantially less." These considerations are clearly not germane to the work of the two branches of the Services. In fact, it might cogently be argued that they are applicable in reverse, since, by the very nature of the case, the time of the medical officer is very seldom fully occupied, whereas, both in peace and in war, his dental colleague always has, or should have, enough work on hand to keep him steadily employed during every working day in the year. It has, moreover, to be borne in mind that the Spens Committee restricted their proposals regarding differentiation in remuneration to general practitioners, and specifically recommended that dental specialists and consultants "should be remunerated within the same range as medical specialists." That is to say, that where the element of longer working hours and restricted leisure is not in operation, there is no case for any differentiation in reward. It is clear, therefore, that if a reasonable proportion of young dental surgeons is to be induced to take up a permanent career in the dental branches of the Services, the removal of this long-standing anomaly in pay is an essential first step.

This is, however, not the only reform which is urgently necessary. At present, the rank held by the Directors of each of the three dental branches is apparently determined by reference to the size of the Branch under his command. The application of this rule of thumb method leads to a block in the channels of promotion, and the premature retirement of officers who do not obtain promotion—a prospect which can hardly commend the Service concerned to an ambitious young man with both clinical and administrative talents. This state of affairs is at once undesirable and indefensible, and it should be rectified without delay. The heads of each of the dental branches carry similar reponsibilities for the conduct of their respective branches, and they should, as a matter of course, hold equivalent ranks. Although the number of officers under their commands varies with very wide limits, the three

medical directors of the Services all hold comparable ranks, and there can be no valid reason why the same principle should not apply in the case of the dental branches.

The decline of the School Dental Service, and the operation of the National Service Acts, have placed special responsibilities on the dental branches of the Forces of the Crown, in that they provide some measure of organised care of the teeth of the large numbers of the adolescent section of the population who are either not regular patients of a dentist in private practice or who are unable, for one reason or another, to avail themselves of the service of a private practitioner during their military service. This responsibility cannot adequately be discharged by the Services unless they have at their disposal a sufficient number of highly trained officers to man the administrative grades. This condition can hardly be fulfilled until the anomalies to which we have drawn attention have been rectified.

NOTES AND COMMENTS

Parliament and The School Service

THE short debate, initiated by Squadron Leader A. E. Cooper, in the House of Commons on May 8 which is reported on another page, was, perhaps, the most enlightening of all those which have taken place on this important subject. The figures quoted by him of the conditions which obtain in Ilford were a graphic illustration of the results which have followed on the decline in the number of school dental officers. He said that in 1938 there were 19,000 children on the school roll and there were 22,820 dental inspections, whereas in 1949 the corresponding figures were 21,123 school children and only 3,757 inspections. There was general recognition of the fundamental need to increase the number of dentists, but the main interest of debate centred on the short-term policy to be adopted during the interim period which must elapse until this primary objective had been attained. Squadron Leader Cooper advocated the employment of private practitioners on a rota basis at sessional rates "somewhat higher than is paid today." Mr. Baird believed that the long-term solution was for the Ministry of Health to take over the service and administer it on a regional basis, in collaboration with the education authorities. Several members who spoke in the debate welcomed the advice given by the British Dental Association to private practitioners that they should devote half a day per week to the treatment of school children in an endeavour to tide over the immediate difficulty. Some members went further. Mr. George Thomas, for instance, suggested that new entrants to the profession should be required to do two years in the school service before going into general practice—an idea which is not likely to commend itself to those who realise the special qualifications, other than professional, required for children's dentistry. On the question of remuneration Dr. Chas. Hill, referring to the disparity between the salaries of school dental officers and private practitioners, said "Others will say with much greater justice that the remuneration of the School Dental Service has remained far too unattractive in relation to current conditions." He went on to suggest that the Minister, having found a speedy method of reducing remuneration, might well intervene to secure a prompt adjustment of the salaries question. There was some cautious comment on the possibilities of applying the New Zealand scheme in this country—the outstanding theme being "we want our children to be assured of the best treatment being given them as expeditiously as possible." It is legitimate to hope that this debate will have done something towards hastening negotiations for the settlement of a national scale of salaries. It is certainly all to the good that so many M.P.s of both parties are now fully alive to the seriousness of the position which has developed and are pressing for a solution, although, as Dr. Hill justly observed, the situation is in part irreversible.

Aptitude Tests for Dental Students

APTITUDE tests for applicants for entry to dental schools have been used in a number of schools in America during the past five years. These have been found to be a useful means of predicting whether students will be successful and it is reported in *J. Amer. dent. Ass.*, **40**, 470, that the Council of Dental Education of the American Dental Association have now approved a plan under which class enrolling in October 1951 may take the test on any one of four occasions and at approximately 80 centres. The first group of tests will be held this autumn using the facilities of the 39 co-operating dental schools. In addition aptitude testing will be conducted in 36 other centres scattered throughout the United States and Puerto Rico, Hawaii and Alaska. The average student applies to three or four schools for entrance but takes only one test and pays one examination fee. The Council sends the records to the schools. Of the estimated 10,000 or 11,000 applicants to dental schools each year, possibly 8,000 will be given tests; of these, about

3,150 students are likely to be accepted. It is further reported that, in future, admission to the Dental College in Denmark is to be granted on the basis of proficiency in basic sciences, additional consideration being given to manual ability.

Sections

A VERY satisfactory feature of the proceedings of the last meeting of the Representative Board was the formal sanction given to the formation of no less than sixteen new sections. In the not very distant past the average number of members in each of the branches made them the natural divisions of the parent body. Now, however, some of the branches have almost as many members as had the whole Association in those days and it is clear that, in whatever way the branches may be reorganised in the future, further subdivision is essential if all the members are to be enabled to take an active part in the work and affairs of the Association. The increase in the number of sections is, therefore, to be welcomed as a sign of healthy expansion.

Percy R. Howe

WHEN a man gives his name to a treatment he is often regarded as an immortal. This must be the case with Percy Howe of silver nitrate fame. He has passed away at the green old age of 85. He qualified in 1889 at Philadelphia. Although the operative dentist associates his name with silver nitrate, research workers in vitamin deficiencies recognise him as one of the earliest and foremost in this work from the dental point of view. Howe was one of those versatile research workers to whom every department of his profession provided absorbing and enthusiastic interest. Pyorrhœa—dental caries—root canal treatment—importance of first molars, salivary factor in dental caries, the effect of scorbutic diet upon the teeth, focal infection, pulp conservation, decalcification of teeth and bone and regeneration of bone through diet. In his last years this question of diet absorbed his attention. He was head of the research laboratory of the Forsyth Institution and director of the Infirmary in 1917. He was one of the three persons to receive the A.D.A.'s Award of Merit and in 1948 he was made a Fellow in Dental Surgery of the Royal College of Surgeons of England.

Fifty Years Ago

From the "Journal of the British Dental Association," April 14, 1900.

If we do not freely and frankly accept the bench work as part of our joyful service to the patient, we shall ere long lose it altogether. Let us away with the foolish pride that there is anything derogatory or undignified about this branch. Our great sage, John Ruskin, who has so recently gone to his rest, says : " There is no action so slight or so mean but it may be done to a great purpose, and ennobled therefore." And it seems to me that this is peculiarly applicable in our case. Much that we do is, or should be, artistic, and if we lose touch with the workroom sorry and unnatural work will be the inevitable result.

From a Paper on Training in Mechanical Dentistry by J. C. Storey.

LETTERS TO THE EDITOR

THE BENEVOLENT FUND

SIR,—At the Dental Group Dinner held at the Mayfair Hotel on April 21, a cheque for £200, the surplus funds of the Group, was handed to me for the Benevolent Fund. Therefore, as Treasurer of the Fund, I take this opportunity of thanking the whole of the Group Movement for this most generous gift. I would add that it has come at a most appropriate time, when our outgoings to the beneficiaries are rather greater than the sum of our subscriptions and donations.

Yours faithfully,
E. B. DOWSETT.

FLUORINE AND WAR-TIME DIET

SIR,—It appears to me that Dr. Weaver has overlooked one or two small points in analysing his figures. During the war calcium was added to the national loaf, and this would "neutralise" the effect of the soluble fluorides on the teeth, and greatly decrease the amount of soluble fluorides absorbed into the bloodstream. Bread with a high calcium content, sticking to deciduous teeth, would effectively prevent the formation of a calcium fluoride crust upon the surface of the teeth, and therefore these teeth would in time become more susceptible to dental caries, were it not for the fact that during the war, when toothpowder and toothbrushes were scarce and everyone was in a state of distress, it was unlikely that the children of South Shields brushed their teeth with the same regularity as they did before the war, and therefore did not brush off as effectively the old deposit of calcium fluoride from the surfaces of the teeth, nor did they encourage fermentation by the more regular use of "neutralising agents." On the one hand, therefore, we had the effect of calcium in the bread neutralising the caries-inhibitory effect of fluorides upon the teeth, and on the other hand, the children, by decreasing their brushing activities, kept up the illusion of a general war-time decrease in caries among European nations only.

"Caladh,"
Fort William.

Yours faithfully,
CHARLES DILLON.

THE AMALGAM RESTORATION

SIR,—It is possible for one having no authority in this realm to err, but Mr. Frost would appear to have worried unduly about his bad schooling.

If he would use a wide matrix band on all possible occasions, and overpack his moist pack, then, at the appropriate moment, strike off the surplus with cuttlefish strip and carver, he would for all practical purposes have a lasting homogeneous filling.

Old Farm Cottage,
Wavendon, Bletchley,
Bucks.

Yours faithfully,
JOHN C. DOMINICK.

BRINGING ORTHODONTICS TO THE SCHOOL CHILD

SIR,—Mr. Hallett's figure of 760 as the number of cases a full-time orthodontist might have under treatment at one time is, I feel, unduly optimistic. It seems to make insufficient allowance for such factors as illness, broken appliances, time required for making or designing appliances, and for writing reports. I also find myself in disagreement with his assumption that most cases need only be seen four or six times a year : most cases benefit from supervision at approximately monthly intervals, both from the point of view of maintaining appliances at maximum efficiency and in order to keep the full co-operation of parents and child.

No one can legislate for others in this matter, but my personal experience suggests that a whole-time orthodontist could have 200 to 240 cases under treatment at one time, of which some 25 per cent would be under retention. I feel that any intending orthodontist would be wise to budget for the lower figure. On the other hand, Mr. Hallett's figure of 100 new cases per year may be nearer the mark : if so, his overall conclusions as to the number of orthodontists needed would not be affected.

It may not be desirable, however, that we should aim at creating 400 full-time orthodontists at the present time. There must be a balance between prevention (e.g. by regular conservative treatment) and cure. The demand of parents for orthodontic treatment for their children is not always accompanied by an equal desire for conservative work, and all-round suitability must be weighed against the fact that perhaps 10 children could receive conservative treatment for every one accepted for orthodontics. Nor is it desirable to divorce orthodontics too completely from general dentistry ; a continuous contact with normal mouths is valuable as a background, and—dare one say it ?—the fewer orthodontic patients a dentist has in his earlier years, the fewer the number of irrevocable mistakes. The acquisition of orthodontic experience is a slow and costly process, and training is not the end of the road but its beginning.

47, *Grosvenor Road*, Yours faithfully,
Coventry. E. K. BREAKSPEAR.

FOOD AND PREVENTIVE DENTISTRY

SIR,—I noticed in the public press that an alteration in the extraction rate of flour was suggested in Parliament, in order that bread may be made whiter, and to produce more feeding stuffs for stock. It is well known that in this process a proportion of valuable calcium and phosphorus salts and vitamins are eliminated. Nearly thirty years ago I was on a committee appointed by the B.D.A., to inquire into food adulteration, over-refining, and deficiencies in modern diet, and read a paper, about the same time, at a meeting of the Southern Counties Branch of B.D.A. at Tunbridge Wells. Many authorities have stressed the importance of cleanliness and quality of food and the necessity to prevent the elimination of the above, through over-refining and deterioration in tins and packets when stored for long periods. The physical effect of this over-refining is of course seen in nearly all jaws, and one seldom sees room for 32 teeth.

The indirect effect is again under development, through early loss of deciduous teeth from caries. We are all familiar with cases of pre-school children having very carious molars extracted between 3–5 years of age and 6-year-old children with cavities in the 1st permanent molars. We also know, in the former case, that the 1st permanent molars are going to erupt too far forward and cause irregularities unless they, or other teeth, are extracted later.

Generally it is useless to expand arches which are already too small for the number of teeth. The best teeth and developed jaws I ever saw were in a Lithuanian, whose bread was made from very dark wholemeal flour. I practised in Kenya Colony, East Africa, for twenty-three years and noticed that natives in the reserves with natural rough food had very little caries. The teeth were mostly regular in well-developed jaws, and consequently parodontal disease was infrequent. The Indians did not have caries to any great extent, but, owing to the softer consistency of their food, were more prone to parodontal disease. When the natives came into contact with civilisation—especially the native cook type who used to live, to a great extent, on European food, carious teeth were often seen. Unless we reform our food habits and prevent further deterioration of essential foods—preventive dentistry cannot be built on a sure foundation. I suggest that a start is made with bread, and that it should be made compulsory for the date of manufacture to be stamped on the container of all tin and packet foods—together with the name and amount of any added preservative or chemical. The latter should apply to all foods.

I returned to England after twenty-four years abroad, and found that there is still a large percentage of children with caries and underdeveloped jaws, and the priority service to cope with this serious situation inadequate.

An adequate, satisfied and well-paid school dental service is not only necessary to improve the nation's teeth, but general health also. It would save money, taking the long view.

The Oaks, Yours faithfully,
Ashley Road, C. E. THOMAS.
New Milton, Hants.

XYLOCAINE

SIR,—Further to the recent article on Xylocaine, it may interest readers to know that, in daily practice, of 54 mandibular nerve blocks, 47 were completely successful, 87 per cent, and of 26 cases of submucous injection in the maxilla, 24 were completely successful, 92 per cent. The nerve blocks were given with Xylocaine 2 per cent and the submucous injections with the 2 per cent special solution. All were given for cavity preparation, and " completely successful " means complete pulpal anæsthesia. The figures for the maxilla include all the teeth except the 2nd and 3rd molars. The percentage of successful cases is higher than that in other tests, using Novocaine alone. I have the complete records of these cases, of which the above is merely a brief summary.

Yours faithfully,
NORMAN SIGGERS.

177*a*, *Denmark Hill*,
*London, S.E.*5.

REVIEWS AND ABSTRACTS

A TEXTBOOK OF BACTERIOLOGY FOR DENTAL STUDENTS. Third Edition. By Arthur Bulleid, L.R.C.P., M.R.C.S., F.D.S., Lecturer in Special Bacteriology, Guy's Hospital Dental School, Dental Surgeon, Guy's Hospital, London, and C. W. Shuttleworth, L.R.C.P., M.R.C.S., F.D.S., Assistant Clinical Pathologist, Dental Department, Guy's Hospital, Senior Dental Surgeon, Miller General Hospital, Greenwich, Dental Surgeon, Memorial Hospital, Woolwich. William Heinemann Medical Books Ltd., 1949. Price 25s.

This small book presents for the dental student a brief account of bacteria, the methods by which they are studied and their relationship to human disease generally but with special reference to oral conditions. The elements of hæmatology are also described and there is a short chapter on the amœbæ found in the mouth. Since the previous edition of 1937 much revision has been made and chapters on Antibiotics and Chemotherapy are now included.

In spite of considerable alteration some rather outdated ideas persist : for example, Holman's classification, by fermentation reactions, of the streptococci into 16 named species is no longer accepted and the section on vaccines fails to give a clear picture of present ideas about their use and the way in which they act. In general the chapters on individual bacterial species are well and concisely presented with, however, more about some aspects, particularly biochemical reactions, than should be required by the student : the importance of tellurite media in the diagnosis of carriers of *C. diphtheriæ* could well have received emphasis and the use of modern selective media for the salmonella-dysentery group of organisms is not mentioned. In these and some other respects the book would be improved by a more discriminating selection of facts which would stress the practical application of the subject.

Our knowledge of the role played by bacteria in common dental and associated conditions remains, of course, very incomplete : the authors deal effectively with this largely problematic part of the subject. They mention Pincus's work on the initiation of dental caries and provide a useful account of what can be done in the investigation of diseased dental tissues.

There is a considerable demand for a concise and readable textbook from which the dental student can obtain a knowledge of the essentials of bacteriology and of its application to his own field. Although some corrections and amendments are required before it can be recommended unreservedly, this book goes a long way towards fulfilling these requirements.

INTERNAL MEDICINE IN DENTAL PRACTICE. Third Edition. By Comroe, B. I., A.B., M.D., F.A.C.P., late Associate in Medicine, Schools of Medicine and Dentistry in the University of Pennsylvania ; Collins, L. H., Jr., A.B., M.D., F.A.C.P., Associate in Medicine, Schools of Medicine and Dentistry of the University of Pennsylvania, etc. ; Crane, M. P., B.S., M.D., Chief Physician, The Misericordia Hospital, Philadelphia, etc. Henry Kimpton, 1950. Pp. 550. 45s.

Internal Medicine in Dental Practice by three American physicians gives an excellent account of medicine for dental surgeons. It contains rather more medicine than is usually expected from British dental students, who can obtain all they need from one of the smaller standard English textbooks, incidentally at a lower price. But it should serve as a valuable work of reference for any dentist interested in keeping his ideas of medicine up to date.

This, however, is not the only value of this book. " Unfortunately," say the authors, " most medical men know very little about the teeth and their disorders . . . " As a medical man himself, your reviewer couldn't—in the modern jargon—agree more. It would be well if all physicians were to read the sections on dental consideration in relation to disease in various systems, and the chapter on foci of infection. Real information on these subjects is sadly lacking, but the authors of this book are to be congratulated on presenting well what information there is ; and on making a most creditable attempt to present a reasonable discussion of the relations between medicine and dentistry.

The book is well printed, with copious references. The illustrations are good, particularly some of those in colour, though on Plate IV (p. 468) an example of the " geographical tongue " (a harmless congenital abnormality) appears labelled as the tongue of nicotinic acid deficiency.

This book can be recommended both to dentists and to doctors wishing to learn something about the relationship of dentistry to medicine.

Theoretical Considerations of Certain Phases of the Caries Problem.—Caries is not a continuous process but consists of a long series of short periods of decalcification. The acids are formed rapidly as a result of a series of enzyme reactions on residual carbohydrate which persists in the less readily cleansed portions of the teeth. Although the conditions necessary for acid production are present in all mouths, whether caries is active or not, the conditions are only optimum at times and will vary from mouth to mouth and even in different areas of the same mouth. In addition to this attacking force every mouth contains a mechanism of varying degrees of efficiency which tends to protect the teeth against acids. These protective influences are usually associated with local environmental conditions of the mouth, which in turn may be influenced by systemic or hereditary effects. They are usually associated with the amount and quality of the saliva, and the anatomical aspects of the mouth and teeth. Whether a carious lesion develops depends upon the balance maintained between acid formation and the protection afforded against acids. It is well established that caries can be controlled by preventing acid formation or by increasing the protective ability of the mouth. Thus, it can be controlled by eliminating sugar from the diet and by oral hygiene procedures. Acid can be prevented from forming by destroying or inhibiting any of the enzymes involved in the process by the use of such substances as fluorides, urea, vitamin K and ammonia. The protective influences can even be increased by operative procedures and orthodontics by removing stagnation areas. Although the general

mechanism of caries is thought to be understood there are many aspects which are unsolved. We cannot explain why the sugar and acids of fruit juices do not produce caries ; on the contrary they seem to afford considerable protection against caries. Some plaques, especially those in immune mouths, are not harmful. Bibby has suggested that some types of plaque are beneficial while others are harmful. Regardless of the source and composition of the plaque it would seem that anything so consistently present in a biological system should have some useful function provided it has not been altered by external factors.[1] Bacterial plaques may exert a similar function to that of the gastric mucin which protects the gastric mucosa from the effect of gastric acid. Plaques are of two kinds : one is the soft material known as materia alba, the other is grey in colour and tough and is more acid. When a dilute solution of sugar is applied to a plaque, although much acid is formed, the pH of the plaque is altered very little. This is because the dilute sugar penetrates very slowly into the plaque and at about the same rate as saliva. On the other hand if a concentrated solution of sugar is applied it exerts a high osmotic pressure and penetrates quickly and deeply into the plaque. Acid is formed rapidly and the pH of the plaque falls, especially as the osmotic pressure exerted by the sugar causes the withdrawal of water from the plaque. So much acid may be formed that the buffering capacity of the plaque is exceeded. As soon as this happens only quantities of alkali equal to the amount of acid formed can prevent the pH falling still further. It is known that a tooth *in vitro* cannot withstand the acids present in many fruits and vegetables ; for example, orange juice will etch enamel in a few hours. This decalcifying action of acid foods has only been recognised *in vivo* when extreme quantities have been ingested ; this is because the teeth are normally protected by a plaque. If as a result of hygiene measures plaque is absent, then acid food will lead to loss of tooth substance. This is the explanation of erosion which does not ordinarily affect the approximal surfaces where the dental plaque is relatively undisturbed. Theoretically acid formation in plaques could be prevented if an enzyme inhibitor could be incorporated within them. In order that the inhibitor would stay there it must either have an affinity for the protein of the plaque or must exert a high osmotic pressure. Penicillin would in some ways serve very well. It will persist in a plaque for twenty-four hours, but its continuous use may produce a tolerance so that if it were required to combat a more serious infection it might be ineffective. Nevertheless a vigorous search should be made for an antibiotic without this disadvantage, or it may be possible to synthesise a suitable compound. In caries the interprismatic cement substance of enamel is dissolved first, after which the prisms are dissolved or otherwise destroyed and the carious area assumes the form of a cone with its apex towards the dentine. The lesion may reach the dentine before the contour of the enamel is broken. *In vitro* this is not so and the usual finding is a cupping out of the enamel surface with very little penetration in advance of enamel destruction, and the cone shaped lesion with no break in the contour of the surface is never seen. When a polished surface of enamel is etched the ends of the prisms are found to be cupped out leaving the interprismatic substance raised above the surface, i.e. the prism dissolves more quickly than the cement substance, the organic matter of which appears to impede the action of the acid. Electron microscopy has shown that the prisms are composed entirely of crystals of hydroxyapatite while the interprismatic substance is composed of similar crystals and also protein. The space lattice pattern of the apatite crystals is not known exactly but the ionic structure may safely be regarded as a labyrinth of calcium, phosphate and hydroxyl ions a relatively great distance apart. In the interprismatic substance, which contains also the huge non-ionic protein molecules, ionic centres must be widely separated and the distance between calcium ions is much greater than in the prisms themselves. Dentine contains much more organic matter than the interprismatic substance and the calcium ions of dentine are therefore still more widely separated. This molecular arrangement of the dental tissues is important because their dissolution in caries depends upon the replacement of the calcium ions with hydrogen ions. The tooth may be regarded as a semi-permeable membrane between the blood on one side and the saliva on the other. In ordinary circumstances the osmotic pressure of the blood is slightly higher than that of saliva and there is a tendency for a constant flow of ions or molecules from the blood to the saliva while water will tend to flow in the opposite direction. This applies providing the substances are small enough to get through. The hydrogen ion is the smallest and could probably go between the loosely packed crystals of the interprismatic substance. The hydrogen ion would displace the first calcium ion it met and, the calcium ion then becoming water soluble, a submicroscopic hole is produced in the enamel. This would still further facilitate the passage of the hydrogen ions and long before the holes were large enough for bacteria to gain access they would be large enough to permit the large molecules of sugar and enzymes to penetrate and dissolution of dentine could commence without there being any macroscopic breach of the enamel surface. The osmotic pressure differential between blood and saliva is an essential factor in the production of caries *in vivo* and explains why in cases of opalescent dentine in which the pulp is absent, and in teeth from which the pulps have been extirpated, the teeth do not decay in the typical manner. Caries in such cases is very much like *in vitro* decalcification.—Fosdick, L. S. (1949) *Northw. Univ. Bull.*, **50**, 4.

[1] Teleological argument of this kind is very misleading. The assumption that every biological structure must have a beneficial function is unwarranted, even if the plaque does happen to have one, as Fosdick suggests.—Ed., *B.D.J.*

Nasal Polyp Extending Through the Hard Palate.—A man of 55 years complained of a small mass of tissue which had been present for five months in the mid-line of the hard palate. The mass, which was soft and pedunculated, was removed under local anæsthesia and histologically proved to be a nasal polyp. Other nasal polyps were removed by a rhinologist. X-ray examination revealed a slight separation of the median palatine suture in the region of the incisive canal and it is suggested that arrested development of the palatine processes in this situation permitted the nasal polyp to herniate into the mouth.—Gross, P. P. (1950) *Oral Surg.*, **3**, 198.

Maxillo-mandibular Relations in the Teaching of Denture Prosthesis.—Pre-extraction records made prior to the extraction of teeth provide the only reliable means of getting the exact vertical dimension of an individual patient. This is an individual patient problem and the use of calculations without judgment may endanger success ; the free-way space or distance between the teeth in the rest position must be considered ; also the facial profile in the rest position. Over-opening of the vertical dimension may be followed by detrimental results ; likewise over-closure is poor practice. The free-way space varies from 2 to 5 mm. Vertical dimension is generally estimated with bite rims in contact and so one may readily over-open many cases. Support of facial tissues should be obtained by a proper arrangement of the anterior teeth rather than by bite opening. " Bite-opening," in excess of the natural amount, interferes with muscle balance and may result in resorption of supporting structures, as well as affecting the appearance. Dentures must be provided for many patients without pre-extraction records, it then becomes necessary to estimate the vertical dimension. The cephalometer is probably the best method to measure the free-way space but such instruments are not readily available and a more simple clinical procedure is required, such as proposed by McGee, which is a system of facial measurement based on individual types of patients : Centric relation is a three-dimensional relationship between mandible and maxilla in which the condyles are in the most distal unstrained position in the glenoid fossa from which lateral movement can be made. Correct centric occlusion makes a positive stop between the upper and lower teeth upon closure of the jaws ; the buccal cusps of the lower teeth make a positive contact on the walls of the central fossæ of the upper teeth ; the best test of centric relation is the Gothic arch or arrow point tracing. The lingual cusps of the lower teeth may be reduced to cut down masticatory stress occasioned by the trapping of food in the rectangular grooves. This free escape of food lingually as the teeth pass from the working to centric relation is a natural condition seen on human skulls. Patients with a natural lower retraction may attain somewhat improved æsthetics by placing the teeth in slight protrusion at the expense of the temporo-mandibular articulation. Patients with a normal profile are frequently converted to lower protrusion by a faulty centric relation. The only reliable check for this seems to be the Gothic arch tracing which almost all reliable technics incorporate in one form or another. With a correct centric relation without freedom of movement, the patient can and usually does manage to crush food. Chewing efficiency can be multiplied many times by incorporating a lateral movement using cusps passing over the ridges as line cutting tools. In natural dentitions a loose relationship between cusps and grooves and fossa is the rule not the exception, and so it seems desirable to follow nature and cut down the actual amount of contact between opposing teeth. Many experienced operators make satisfactory dentures based upon trial and error rather than upon basic principles, using the mouth as an articulator and time, judgment and experience in place of principles. Teachers preparing students cannot teach judgment but should give the students an understanding of the basic principles and thereby immeasurably improve denture prosthesis.—HUGHES, G. A. (1949) *J. dent. Educ.*, **13,** 133.

Copper Plating of Reversible Hydrocolloid Impressions.—A special copper electrolyte is used. As a preliminary, the impression is soaked in the electrolyte for two minutes. It is then removed from it and iron powder is blown on to the surface to be plated. The copper ions in the solution absorbed by the hydrocolloid displace the iron ions in the iron powder, to form a fine coating of copper which allows perfect conduction of the current. Electric contact is made by embedding 1 mm. of the enamel free end of the 26 guage wire used into the surface of the impression. The plating must be done quickly, to prevent burning the copper, and to cover the surface with copper plate within 15 minutes lest the volume of the hydrocolloid changes. To aid the process, a mechanical agitator is used to disturb the electrolyte. One hundred milliamperes are applied for each tooth area for a period of five minutes. If progressing favourably, the current is doubled and the process is completed in three hours. Later a model is cast in an artificial stone. Any size or impression may be plated by this method, but for a full arch a much heavier type of apparatus is necessary than that at present used for copper forming in dentistry.—DWIGHT, O. D. (1949) *J. dent Res.*, **28,** 456.

The Occurrence of Beta Hæmolytic Streptococci on the Gingiva of Normal Young Adults.—In view of the fact that the danger from oral carriers of hæmolytic streptococci might be as great or greater than that from throat carriers, an investigation was undertaken into the occurrence of these organisms in the oral cavities and throats of 500 normal young adults. Cultures were examined from the tonsillar region and from the labial gingiva of the lower anterior teeth. Hæmolytic streptococci were found in 11·6 per cent and on the gingiva in 6 per cent. Among the 77 persons in whom streptococci were found in either throat or mouth, 61 per cent were positive in throat alone, 24 per cent in mouth alone and 14 per cent in both throat and mouth. It is concluded that the gingival carrier is less common than the throat carrier and that in a minority of cases hæmolytic streptococci might exist on the gingiva without their coexistence in the throat. The examination of persons for the presence of beta hæmolytic streptococci should therefore include cultures made from the gingiva as well as the throat.—NASSLER, M., and MACDONALD, J. B. (1950) *J. dent. Res.*, **29,** 43.

The Experimental Production of Jaw Tumours in Hamsters.—Pellets or crystals of a carcinogen, 9, 10-dimethyl-1, 2-benzanthracene were inserted into the body of the mandible in five hamsters and beneath the gingiva in another group of animals. Within five months eight of the ten animals developed fibrosarcomatous tumours of the jaw and in one case a rhabdomyosarcoma. The bone and periodontal membrane was invaded, the pulps of the molar teeth underwent necrosis, presumably because the tumour mass interfered with the blood supply. The pulps were not invaded. The tumours did not metastasize but in some cases the tumours were successfully transplanted to other hamsters.—LEVY, B., and RING, J. R. (1950) *Oral Surg.*, **3,** 262.

THE HEALTH SERVICE

THE TEN PER CENT CUT

Prayer to Annul the Regulations

On May 15 Parliament debated the latest Regulations reducing dentists' remuneration on the motion of Mr. J. Baird (Wolverhampton, N.E.) that the Regulations should be annulled. Speakers on both sides of the House took part in a debate which lasted for over two hours before Mr. Baird eventually withdrew his motion. The debate will be reported more fully in the next issue of the Journal.

ORTHODONTIC TREATMENT

The subjoined memorandum (E.C.N.53) on the provision of orthodontic treatment under the General Dental Service has been sent by the Ministry of Health to Executive Councils for circulation to all dentists on their lists.

(1) The following notes have been prepared by the Minister of Health with a view to answering some of the questions which have arisen in relation to the provision of orthodontic treatment under general dental services.

(2) A dentist who has accepted a patient under the general dental services may arrange for another dentist to give, as his deputy, any necessary part of the treatment, including any necessary orthodontic treatment ; the deputy need not be on the dental list. The estimate initiated by the dentist who had accepted the patient would be used for the whole treatment. The first dentist would be responsible for all acts and omissions of the deputy : he would claim the appropriate fees from the Executive Council, and be responsible for reimbursing his colleague.

(3) Alternatively, if he is unable (either personally or through a deputy) to provide the necessary orthodontic treatment, he can (under paragraph 4 of his Terms of Service) refer the patient to either :

(*a*) any hospital where such treatment is provided ;
or

(*b*) to one of his colleagues on the dental list who he knows undertakes such work. If the arrangement in such a case is for the first dentist to provide all other necessary treatment, and for the second to provide the orthodontic treatment, it helps the Dental Estimates Board if each dentist in submitting his estimate for that part of the treatment which he is providing, will inform the Board of the arrangement with the other.

(4) The words " is unable " in paragraph 4 of the Terms of Service are not defined. While each case would depend on the actual facts, generally the Minister would incline to the view that, where a dentist who had accepted a patient under the general dental services referred the patient (in the way mentioned in paragraph 3) to the hospital service or to another dentist, because he felt that the orthodontic treatment would be provided more satisfactorily and conveniently for the patient in this way, it could not be held that the dentist had committed a breach of his Terms of Service.

(5) It is recognised that, owing to the shortage of dentists who regularly undertake orthodontic treatment and to the fact that the available hospital facilities are limited, it may not always be possible for a dentist who decides to refer one of his patients for orthodontic treatment to another dentist or to the hospital service to ensure that the patient receives such treatment without waiting.

(6) Subject to what is said above, a dentist who has accepted a patient under the Service is obliged to provide all the treatment necessary to secure dental fitness which the patient is willing to undergo.

(7) It may also happen that a dentist, while willing to provide all the necessary treatment, including orthodontic treatment, himself, will wish to have advice, e.g. as to diagnosis and prognosis, before proceeding. Here again, two courses are open:

(*a*) The dentist may refer the patient to a hospital for advice.

(*b*) The dentist may refer the patient to another dentist. In such a case the dentist would need to pay to the other dentist whatever fee is agreed between them for the consultation ; in this connection, it should be borne in mind that, in fixing the total fee for the case, the Dental Estimates Board make an allowance for the diagnosis which takes account of the need in some cases for having a second opinion.

(8) The procedure for referring patients to the hospital service is briefly indicated in paragraph 7 of E.C.N.18.

QUESTIONS IN PARLIAMENT

Chemists' Remuneration

Mr. Mott-Radclyffe (Berks, Windsor) asked the Minister of Health why the decision to reduce the rate of payments to Chemists for National Health prescriptions from May 1 was taken without reference to the machinery of negotiation provided through the Whitley Council, in view of the fact that the contract between his department and the Pharmaceutical Association provides that the fixing of profit margins should be negotiated through the Whitley Council.

In a written reply Mr. Bevan said that the matter was referred to the Whitley Council on March 18 and that negotiations were still proceeding. The Minister said that he had undertaken to accept whatever percentage reduction was agreed by the Council or awarded by an arbitrator.

In a written reply to a question by Mr. Deedes (Kent, Ashford) on the new arrangements for remuneration of chemists, the Minister of Health said that the amount of the overhead on-cost, added to the price of drugs and certain appliances, was to be reduced from 33 per cent to 16 per cent on May 1, but if a different percentage were agreed on the Whitley Council, or were awarded by an arbitrator, that different percentage would be substituted as from May 1. Mr. Bevan further said that the proposal to reduce the on-cost was submitted to the Whitley Council on March 18 ; the Chemists' Contractors' Committee were consulted on April 14 upon the date on which the reduction should take place.

COMMITTEE ON INTERNAL ADMINISTRATION OF HOSPITALS

The Central Health Services Council have appointed a Committee to study the internal administration of hospitals. Its full terms of reference are:

To consider and report on the existing methods of administration in individual hospitals with particular reference to

(i) Matters of finance, staff and supplies ;
(ii) the extent to which differences in the work undertaken at different hospitals call for differences in their administrative organisation ;
(iii) the extent to which administrative duties should be undertaken by medical and nursing staff.

The Joint Secretaries are Mr. E. J. S. Clarke and Mr. E. W. Bryant of the Ministry of Health. Any person or body wishing to submit evidence to the Committee should in the first place given notice to the Joint Secretaries, Room 28, First Floor, Ministry of Health, S.W.1.

CONSERVATIVE PARTY HEALTH COMMITTEE

THE Health and Housing Parliamentary Committee of the Conservative Party has been reconstituted in the new Parliament with the following officers :—*Chairman* : Colonel Walter Elliot ; *Deputy Chairman* : Miss Horsbrugh ; *Vice-Chairman* : Sir Hugh Lucas-Tooth ; *Hon. Secretaries* : Colonel Stoddart-Scott (Health), Mr. Marples (Housing), Mr. John Hare (Local Government).

Parliamentary Intelligence

SCHOOL DENTAL SERVICE

THE problem of the treatment of school children was again debated in Parliament on the Motion for the Adjournment on May 8, 1950.

The subject was raised by Squadron Leader A. E. Cooper (*Ilford, South*). He reminded the House that the School Dental Service was breaking down largely because dental officers were leaving the Service to take up more lucrative employment in private practice, where they could earn three, four or five times the salary of a school dental officer. He recalled that in 1939 some 783 whole-time school dental officers were employed by the local authorities. That number had risen to 921 in 1948 but was this year down to 738.

He then quoted the figures for dental inspections in Ilford. In 1938 22,820 children were inspected. In 1948 the number of inspections had fallen to 11,467, and in 1949 as low as 3,757, although the number of children on the school roll had increased. It seemed that the number of inspections for 1950 would be something like 2,556.

The first part of the problem was to train sufficient dentists to cover private requirements and the School Dental Service. Secondly there was the immediate problem of maintaining the School Dental Service during the meantime. With regard to the second problem he questioned whether a salary adjustment was necessary for school dental officers. It seemed to him unlikely that the Whitley Council would ever award a scale of salaries which would give the school dental officer anything like the amount which he could earn in private practice. If they secured such a salary what would be the effect on local government administration generally? The School Dental Officer would earn more than the Town Clerk and Borough Surveyor, and would throw the whole thing out of balance. It was unreasonable to suppose that salaries would be fixed at such a level, and it therefcre appeared inevitable that they would be unable to retain dentists in the School Dental Service.

He urged negotiations with the British Dental Association at Ministerial level for private practitioners to provide some sort of part-time service. He referred to the Association's appeal to all dentists to give up at least one half-day a week to treat school children. In his town negotiations had started with a view to setting up a rota system to provide the necessary service. If results were to be achieved along these lines, the Ministry would have to agree to a sessional fee somewhat higher than was being paid today. This in turn would create difficulties because full-time dental officers would leave the Service to take on part-time service at the higher sessional rate.

Mr. Baird (*Wolverhampton, North-East*) remarked that the salaries offered for public dental officers had in fact risen considerably during the last five years. It was one of the problems of the school dental officer that he could not negotiate direct with the Government about his salary, while dentists, in private practice could. Moreover the local authorities were often reluctant to provide dental equipment comparable with that of a dentist in private practice and several school clinics were a disgrace. This was one of the main reasons why young dentists were not going into the School Service.

He suggested that the whole service should be taken over by the Ministry of Health and organised on a regional basis. The cost of equipping the Service would then rest on the National Exchequer and there would be an economy in dental manpower.

Mr. Baird referred to the circular issued by the British Dental Association asking members in private practice to treat school children. As a temporary measure this was a good suggestion. During the last few years child dentistry, being difficult work and taking a bit longer, had not in many cases been popular with dentists and the child had often gone to the back of the queue because of financial considerations. There were, however, a considerable number of dentists who did give priority to school children. It was for the local authorities to consult with the local dentists in order to negotiate a temporary service. The only ultimate solution was to provide more dentists and steps were being taken to open new dental hospitals. One had already opened in Newcastle and he believed that there was to be another in Aberdeen, and another in the North Midlands. There would, however, be difficulty in finding teachers for these hospitals.

Mr. Baird then referred to the employment of dental hygienists in New Zealand. He said that these girls filled and extracted children's teeth and the experiment appeared very successful. He believed that it was something we could adopt in this country. If the report of the Government's mission to New Zealand was favourable, in a very short time we should be able to start drawing upon the right type of young girl to help to relieve the shortage of dentists. Dilution of any profession was always a doubtful subject, but if dilution was limited to the treatment of school children under the supervision all the time of qualified dental surgeons it would not do very much harm. We must look at dental hygienists in the School Dental Service very seriously as a help to solving our temporary problem.

With regard to the salaries of school dental officers, they were themselves to a great extent to blame. The position could have been put right two years ago when the Government asked them to come into Whitley machinery in direct negotiation with the local authorities on the salary question. He knew and appreciated the attitude of the British Dental Association, and he saw that they had now recognised the fact that the school dental officer should set up his own Whitley machinery as soon as possible. There was a possibility that we should get Whitley machinery in the near future.

Dr. Hill (*Luton*) said that the plain fact was there were too few dentists to provide a dental service for the community as a whole. The result of trying to do this had been to deny treatment to the section of the community that needed it most. Even though the position might be rectified in the next few months it still remained true that those children had suffered, and might subsequently suffer dentally, because of that lack of care.

Another difficulty was the difference between remuneration in private practice and in the School Dental Service. Given such a disparity, the result of a dwindling corps of school dentists was inevitable. We should not be content to say that the Minister must await the discussions in the Whitley Council, or that regionalisation was the solution. The first step was publicly to recognise that there were too few dentists for the whole population, and publicly to decide to give priority to the school population, whatever that might mean in the provision of dental care for the rest of the community. Secondly new scales of remuneration for school dentists should be produced swiftly so as to retain them in the Service and attract them into the Service. The Minister found no difficulty in deciding to reduce remuneration where Whitley discussions were going too slowly. Intervention by the Minister was needed here to secure the speediest possible adjustment of the situation. He urged the Minister not to rely on arguments which distributed blame or praise for the various delays which had occurred but to regard this as an urgent problem approaching a national scale in the decay of the School Medical Service under their very eyes.

Dr. Barnett Stross (*Stoke-on-Trent, Central*) said that he believed that young men of energy and vigour would still tend to be attracted outside rather than to the School Service even if the salaries in the School Service were levelled up to accord with the remuneration earned in private practice.

Mr. Baird here intervened to say that the salaries being offered by some local authorities, rising from £1,000, were very near the appropriate salaries recommended by the Spens Committee. The problem was that dentists in private practice were getting considerably more than the sum visualised by the Spens Committee, and in order to get dentists into the School Service again they would have to pay them more than the Spens Committee recommended.

Dr. Stross, continuing, said he wondered whether the introduction of unqualified, or not fully qualified workers, to assist in the Service was a retrograde step. He believed that there was no operation in medicine or dentistry of so trivial a nature but that the more highly qualified and skilled the operator the better ultimately it would be for the patient. It was not only the operative work which was concerned: it was desirable for the operator to be capable of making a diagnosis when the child opened its mouth and exposed its teeth. Everybody was agreed that we wanted our children to be assured of the best treatment being given to them as expeditiously as possible. If the Ministry had made up their minds that men or women with a short training might hope for a time, or permanently, to do this work, well and good. But whatever was done required to be done expeditiously.

He wondered whether one way out could be found by asking every dentist entering the Health Scheme to give a session, or a half-day per week, to the children in his area. In this way children could have the priority for which all were asking.

Mr. George Thomas (*Cardiff, West*) said that he understood that a dentist in Wales received £24,000 last year for one year's work in the Service. This scandalous state of affairs was bound to be an impediment to an adequate School Service.

Mr. Baird here intervened to say that Members should not make general statements without qualifying them and without knowing what they were talking about. The figures quoted would be for gross earnings, of which at least 52 per cent were expenses, and it was quite possible that the dentist concerned employed one or two assistants.

Mr. Thomas said that his points had not been made in vain if he had been able to bring Mr. Baird to his feet to defend the dental profession. This was a remarkable feat for which he took due credit. In some parts of the country dentists were already giving treatment to children on a sessional basis. This had happened in Cardiff. Would it not be possible for new entrants to the profession to be required to do two years' service in the schools before entering into private practice? Dentists must be prepared, like anyone else in the community, to go where there was the greatest need. The problem brooked no delay and in every part of the country we needed a similar scheme to that in operation where the local dentists were loyally taking their turn in the schools or setting hours apart in their own surgeries when the children only could attend.

The Parliamentary Secretary to the Ministry of Education (Mr. Hardman) replied to the debate. He emphasised the need for caution in replying to the many suggestions which had been made. Reports of one kind or another were awaited. Negotiations were afoot for the setting up of Whitley machinery. The likelihood or not of local or national agreement with the dentists as to part-time service was still a matter not only of discussion but of growth and development. He hoped it would be appreciated in the House that he did not want to say anything in reply to this debate which would exacerbate what was an extremely tricky and serious position.

The only long term solution to the problem was to train more dentists. The deterioration of the School Dental Service was due to the steady fall in the number of school dentists. With 921 dentists in 1948 it had been possible to maintain an efficient service with reasonably adequate arrangements for regular inspection and treatment. Even then only about half of the required staff was available to meet an ideal service in the schools. Since 1948 the number had fallen to 738 at the beginning of

1950, because the School Dental Service was no longer as attractive as it used to be to new entrants to the profession. The remuneration of dentists in private practice had been reduced by 20 per cent in June 1949 and by a further 10 per cent in May 1950. These reductions would help to reduce the discrepancy between the earnings in general practice and the School Dental Service.

At the same time it was not possible at present to maintain an efficient service with the number of school dentists available. In some areas it was proving difficult, if not impossible, to provide even emergency treatment, and if the decline of the last eighteen months continued, the conditions now to be found in the worst areas would become more or less widespread throughout the country.

Negotiations had been proceeding for some considerable time to establish a Whitley Council to deal with dentists' salaries generally. One committee of this council would deal with the salaries of dentists employed by local authorities, including school dental officers. Attempts to set up this negotiating machinery had met with a number of difficulties and at different times either the dentists or the local authorities had been unwilling to join in.

Some progress had been made recently but on April 22, 1950, the Representative Board of the British Dental Association resolved not to enter generally into Whitley Council machinery but agreed to a Whitley Council covering public dental officers only. He hoped that the Whitley machinery to deal with dentists in local authority employment might still be set up, and the sooner the better. If the machinery was set up, the question of salaries could be at once considered, bearing in mind always the present situation and general Government policy as to personal incomes. He was afraid, however, that this latest development was bound to lead to some further delay which could be ill-afforded.

The report of the mission to New Zealand was very eagerly awaited. The setting up of a Working Party to investigate the effects of fluoride on school children's teeth was another development of considerable interest, but it would be some years before we would know the results.

The shortage of dentists and the heavy demand for dental treatment by adults meant competition between the General Dental Service and the School Dental Service. In treating the teeth of young children, the foundation was laid for good health in adult years. Members of the School Dental Service had been doing a great job in the schools and he was certain that most of them were not prepared lightly to give up their responsibilities in the Service simply on the ground of increased remuneration outside. If this better balance could be achieved between remuneration in the Service and outside it, he thought that the School Service might be restored at least to the level of efficiency of two years ago.

He recognised that it was the duty of the Ministry of Education, in co-operation with the local authorities and others concerned, to put this matter right as soon as possible and he could, with whole-hearted warmth, support the anxiety of every speaker in this debate. The Ministry were not prepared to allow this service to decline any further. They would do their best to meet the situation and to meet it urgently.

Dental News

FÉDÉRATION DENTAIRE INTERNATIONALE

Individual Membership

It may be of interest to the members of the British Dental Association to learn that in connection with the XIth International Dental Congress to be held in London, July 1952, Individual Members of the F.D.I. of not less than two years' standing and whose subscriptions are not in arrears will be admitted to full active membership of the Congress on payment of half the subscription. Application forms can be obtained from G. H. Leatherman, 35, Devonshire Place, London, W.1.

THE AMERICAN DENTAL SOCIETY OF EUROPE

The Annual Meeting of the American Dental Society of Europe will be held in the Indonesian Institute, Amsterdam from the 19th to the 22nd of July inclusive. For other than members, associate members and official guests of the Society there will be a registration fee of 60 Guilders. Mr. F. Douglas Derrick, 140, Park Lane, London, W.1, is the Hon. Secretary of the Society.

LECTURE ON FULL DENTURES

A lecture will be given by Mr. E. Wilfred Fish, *C.B.E.*, M.D., on "Modelling Full Dentures" under the auspices of the Institute of British Surgical Technicians (Dental Section) on Tuesday, June 6, 1950, at 6.30 p.m., at St. Ermin's Hotel, Caxton Street, S.W.1.

Admission tickets are obtainable on sending stamped addressed envelope to the Institute of British Surgical Technicians, 6, Holborn Viaduct, London, E.C.1.

SCHOOL OF DENTISTRY, UNIVERSITY OF PENNSYLVANIA
POSTGRADUATE COURSES

The School of Dentistry of the University of Pennsylvania is offering 36 Postgraduate Courses during the academic year 1950–51. The subjects covered by the courses include Airbrasive Technic, Cleft Palate Treatment, Ceramics, Complete Denture Prosthesis, Crown and Bridge Precision Attachment Prosthesis, Course for Dental Assistants, Dentistry for Children, Endodontics, General Anesthesia in Dentistry, Mechanical Principles of Restorative Dentistry, Mouth Rehabilitation, Oral Cancer, Oral Diagnosis and Roentgenology, Oral Hygiene, Orthodontics, Partial Denture Design, Periodontics, Periodontics and Oral Medicine, Prevention and Control of Dental Caries, and Roentgenologic Technic and Interpretation.

The Second Mid-Atlantic States Seminar in Oral Medicine at Skytop, Pennsylvania, which will be held November 5 to 10, 1950, immediately following the National A.D.A. Meeting in Atlantic City, is also being offered by the Postgraduate Courses.

Further information about these courses can be obtained from the Director, Postgraduate Courses, School of Dentistry, University of Pennsylvania, 4001 Spruce Street, Philadelphia 4, Pa.

ALL-INDIA DENTAL ASSOCIATION

Dr. N. N. Bery, New Delhi, has been elected President of the All-India Dental Association for 1950. Other officers are President-elect, Dr. M. K. Patel, Bombay; Vice-Presidents, Dr. S. P. Kapadia, Bombay, Dr. R. Ahmed, Calcutta, Dr. U. S. Malik, New Delhi; Honorary General Secretary, Captain S. Bratt, 33, Hanuman Road, New Delhi.

The Schools

Eastman Dental Hospital.—Mr. C. F. Ballard, F.D.S., M.R.C.S.Eng., L.R.C.P.Lond., has been reappointed, for a further term of three years, to the Board of Governors of the Eastman Dental Hospital.

National University of Ireland.—The Senate of the National University of Ireland have appointed Kiernan McGrath, M.B., B.Ch., B.A.O., B.D.S., to be Professor of Dental Surgery at University College, Dublin.

[Examination Results]

Royal Faculty of Physicians and Surgeons of Glasgow.—*Final L.D.S.*—J. Armit, D. Baxter, R. C. Caldwell, L. M. Campbell, B. Caplan, Agnes J. Church, G. C. Clarke, J. D. Dolan, C. F. A. Downie, J. Dunlop, A. Ferguson, F. Glidden, Helen Graham, I. M. Hamilton, Patricia E. Harold, T. J. Harrop, J. Hill, W. M. Kerr, Ada W. Kirkwood, J. D. McCrindle, Joan S. McGregor, W. J. MacKillop (" with honours "), J. O'Connor, Margaret C. Pinkerton, A. G. Rennie, J. A. Scott, J. Short, W. Stevenson, W. A. Thain, W. R. Walker.

The Services

Territorial Efficiency Decoration.—H.M. The King has been graciously pleased to approve of the award of the Territorial Efficiency Decoration (T.D.) to Lieutenant-Colonel D. J. Wiggington, *M.B.E.*, R.A.M.C., Lieutenant-Colonel G. V. L. Williams (T.A.R.O.), Royal Army Dental Corps and Major E. T. B. Graham-Scott, Royal Army Dental Corps, T.A.

Personalia

Mr. J. F. Pilbeam, F.D.S. R.C.S.Eng., has been appointed senior dental officer at Wellhouse and Clare Hall Hospitals, North-west Metropolitan Regional Hospital Board.

DENTIST ARTIST

Mr. W. A. Skinner, Harley Street, London, has had a picture accepted and hung at the Exhibition of the Société des Artistes Français at Le Salon, Paris.

Mr. Skinner is a member of the British Dental Association by virtue of past membership of the Incorporated Dental Society.

Obituary

HAROLD OSBERT SALT, L.D.S.Eng.

The news of the passing of Mr. H. O. Salt of Lock Gates, Tamworth Road, Lichfield on May 1, at the age of 65, will be received with many regrets by all his friends and colleagues in the Metropolitan Branch of which he was a keen member from the time of his joining the Association in 1916 until he left London to take up a school clinic appointment at Lichfield in 1942. He served as hon. secretary to the Branch from 1937 to 1942.

After qualifying from Guy's in 1914 he served as a house surgeon there until June 1915 when he was gazetted a Temp. Lieut. in the Dental Branch of the Air Force. On demobilisation he set up practice in St. Thomas' Street, S.E.1, subsequently moving to Rosary Gardens, S.W.7, where he continued in practice until he left London.

He leaves a widow to whom we offer our very sincere condolences and she has requested that anyone wishing to honour the memory of her late husband should send a contribution to the Benevolent Fund.

HAROLD HARRISON, L.D.S.Eng.
(An Appreciation)

L. L. writes :—

" Harold Harrison was a Guy's man, he qualified in 1910, and later gave up practice at Welbeck Street, W.1, to start a new life in Durban, as his wife's relations lived in South Africa. He bought into a practice, but the partnership was afterwards dissolved and he worked up a good connection on his own account.

" The many friends of Harold will be sad to hear the news of his passing. He was one of the older school, and was of that lovable kindly disposition which I hope will not fade out under present day conditions. He took a great joy and pride in his work, and faithfully gave of his best to his clientele. He and his wife were contemplating a trip back to England to see their old friends before retiring, when he was suddenly taken ill. He leaves a widow, a son, and two daughters to mourn his loss."

Victor William Percival, L.D.S.Eng., of Cheltenham, died on April 15 at the age of 51. He qualified from Guy's in 1924 and joined the B.D.A. in 1933. In the first World War he served as a Lieutenant R.G.A. He played Rugby for Cheltenham College and for Guy's. A prominent Freemason he was P.P.G.Reg. for Gloucestershire. He leaves a widow.

Births

HOWSAM.—At the Park Vale Nursing Home, S.W.16, to Daphne, wife of W. E. Howsam, L.D.S.Eng., a son (Johnathon)—brother for David. May 2, 1950.

PRYSOR-JONES.—On April 28, 1950, at Mill Road Maternity Hospital, Liverpool, to Jean, wife of R. Neville Prysor-Jones, L.D.S.U.Lpool, a son (Richard Wyn)—a brother for Susan.

Deaths

HARRISON.—Harold Harrison, L.D.S., of Guy's Hospital, 1914, passed away at his home in Durban, South Africa, on April 6, 1950.

HAYTON-WILLIAMS.—At Liverpool on May 2, Ronald John Gwynne Hayton-Williams, L.D.S. R.C.S.Eng., aged 38.

SALT.—On May 1, Harold Osbert, L.D.S., devoted husband of Frances Eleanor (*née* Blake), Lock Gates, Tamworth Road, Lichfield, Staffs.

Our Diary

Friday—Sunday, May 19-21.

Scottish Branches.—Conjoint Meeting, Hotel Hydro, Dunblane. Friday : 6 p.m., Address by J. M. Macrae ; 7 p.m., Dinner. Saturday : Golf Outing and Competition, Dunblane Course.

Saturday, May 20.

West Lancashire, West Cheshire & North Wales Branch.—Starkie House, Starkie Street, Preston, 2 p.m. " Lesions of the Oral Mucosa," Professor Martin A. Rushton.

Monday, May 22.

Royal Society of Medicine—Odontological Section.—1, Wimpole Street, London, W.1, 5.30 p.m. Demonstration of Specimens added to the Museum of the R.C.S.

Tuesday, May 23.

Preston, Leyland and Chorley Section.—Starkie House, Starkie Street, Preston. " Current Dental Topics and Staff Wages."

Wednesday, May 24.

B.D.A. Photographic Society.—Annual Meeting, 13 Hill Street, Berkeley Square, London, W.1, 7 p.m. Election of Officers. Showing of Members' cine films.

Friday, May 26.

Bognor Regis and District Section.—Annual Meeting, " Burngreave," Nyewood Lane, Bognor Regis, 7.30 p.m. " Apicectomy," H. M. Pickard.

West of Scotland Branch.—Special Meeting, Royal Faculty of Physicians and Surgeons, 242, St. Vincent Street, Glasgow, C.2, 8 p.m. To consider recent arbitrary action by Secretary of State for Scotland and Ministry of Health.

Saturday, June 3.

Public Dental Officer's Group—Scottish Section.—Midlothian County Rooms, George IV Bridge, Edinburgh, 2.30 p.m.

BRITISH DENTAL JOURNAL

Communications with regard to editorial business should be addressed to THE EDITOR, *BRITISH DENTAL JOURNAL*, 13, Hill Street, Berkeley Square, London, W.1. Telephone : Grosvenor 2761. Telegrams : " Bridention," Audley, London.

Original Articles and Letters submitted for publication are presumed to be offered to the *British Dental Journal* only, unless the contrary is stated.

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